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The Practical Teacher

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The Practical Teacher

A MONTHLY EDUCATIONAL JOURNAL.

Edited by JOSEPH HUGHES.

'Knowledge is proud that he has learned so much,
Wisdom is humble that he knows no more.'—COWPER.

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MODERN EDUCATIONAL REFORMERS.

BY THOMAS CARTWRIGHT, B.A., B.SC. (LOND.),
Author of 'Mental Science and Logic for Teachers.' Late Director of the Birkbeck Training Classes and Lecturer therein on School Method.

No. IX.—JOHANN FRIEDRICH HERBART.

OF the many German thinkers who have applied themselves to the task of wedding practical education with the science of mind upon which it must perforce—whether knowingly or unknowingly—be based, no one has met with more pronounced success than Herbart. In America as well as in the Fatherland he is universally regarded as an oracle with respect to systematic and scientific pedagogics. As Mr. Oscar Browning well says, 'To those who desire to study psychology in relation to education, few writings will have more value than those of Herbart. He was a psychologist of the first rank, the founder, some will call him, of modern psychology. He was also a practical teacher.' It is imperative, therefore, that a place should be found for him in our Reformers' Corner.

It was at Oldenburg, on May 4th, 1776, that Herbart was born. His father was a lawyer; but it was to his maternal parent, the daughter of a doctor of that place and a woman of great intellectual gifts, that the early education of our reformer was committed. His first tutor was Herr (afterwards Pastor) Ulzen, who aimed at training the boy in 'clearness, definiteness, and continuity of thought.' The mother was always present at the lessons, and she even undertook to learn Greek in order that she might play the part of pacemaker to her boy's budding intelligence. It is pleasant to be able to record that, unlike King Lear, who bitterly exclaims,

> 'How sharper than a serpent's tooth it is
> To have a thankless child,'

Frau Herbart was thoroughly appreciated by her gifted son, as the following words show:—'I have begged her not to hide them (her wishes) from me, and you will wish me compensation in the joy of an attempt to lighten her sufferings. My good, my perpetual benefactress! how much that was undreamed of, perhaps unavoidable, has she had to suffer for my sake! How gladly would I repay her, were it in any way possible.' As a pupil Herbart was eminent in mathematics and in physical science; in music also he delighted, as is evidenced by the fact that he wrote a book on harmony and composed a sonata that was performed at his Centenary Memorial Festival. He evinced great aptitude in understanding and reproducing the thoughts of others, a power that stood him in good stead when called upon to criticise the views of other philosophers. At the age of 13 he became a pupil at the Gymnasium of Oldenburg, and when only 14 he wrote a thesis concerning 'Human Wisdom,' which was a highly creditable performance. The concluding words of this essay are worthy of quotation. 'It is contrary to all philosophy to reject an argument against which we have nothing to urge.' In 1794 he delivered a farewell oration wherein again was apparent the philosophic cast of his thoughts, and also proof of his inborn capacity for philosophising. He instituted in this address a critical comparison between the *summum bonum* (or highest good) as indicated in the works of Cicero and Kant and the principles of moral philosophy.

Leaving the Gymnasium when 18, he entered the University of Jena. It was the wish of his father that he should devote himself to jurisprudence, but 'the ruling passion' was in quite another direction, as will readily be believed from what has preceded, and the young student found himself at the feet of Fichte drinking in philosophy instead of acquainting himself with the mysteries and subtleties of law. Very soon he made himself felt not only as a student but as an independent thinker who took exception to the doctrines that were held by his master, which doctrines he endeavoured to refute in a manner that for fairness and courtesy, as much as for clearness and weight, is worthy of all admiration. 'I am very modest in my demands upon human freedom. Leaving that to Schelling and to Fichte, I seek to determine a human being by the laws of his reason and of his nature, and to give him that which will enable

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him to make something of himself.' It is to be remarked that education was from the first linked with Herbart's work in philosophy; indeed, it would be unfair to him to admit that the two could possibly be divided, so necessary, according to his conception, was philosophy to a rational knowledge of the meaning and extent of education. We are therefore not surprised that his thoughts should turn towards teaching as a career, especially as he was encouraged in this by his mother, who had left her husband and taken up her abode at Jena with her more congenial son. In 1797, before the completion of his course of study, Herbart undertook the tuition of the three sons of Herr von Steiger-Reggisberg, the governor of Interlaken. The education of these three lads was left almost entirely to their tutor, a mark of confidence which speaks well for the insight of von Steiger and for the capability of Herbart. Nor was this confidence lacking justification; the three students turned out remarkably well, the eldest becoming a close friend and zealous disciple of the tutor. In his tutorial capacity Herbart was brought face to face with the practical difficulties of teaching, and the golden opportunity of applying his scientific theories to the solution of practical problems was seized with avidity, resulting in a 'little collection' of carefully arranged observations and experiments which was, later on, utilised by him in writing his works on education. 'Here'—to quote Mr. and Mrs. Felkin, to whose translation of 'The Science of Education' and 'The Aesthetic Revelation of the World' (Sonnenschein) we are greatly indebted—'Here he first conceived the thought of an *educating instruction*. Here we find him endeavouring to arouse in his pupils a *many-sided interest*, and to intertwine the pupils' interest with his own, by mutual study of the same subject. Here, in a word, he gained that wealth of educational experience which enabled him twelve years later, when he had made trial of its worth practically and theoretically, to write as follows:—"The teacher, as tutor to two or three pupils, creates his own school. To him who hears the true artist's call to education, the small dull space in which he at first perhaps feels himself confined soon becomes so bright and large that he discovers the whole of education therein, with all its motives and needs, the satisfaction of which is truly a work immeasurable. Be he ever so learned, the boundary line of his knowledge must fade away in the face of all that amongst which he ought to choose, if he would find what is best suited to his pupils. If he *be* at once strong and flexible, nevertheless *the* strength and *the* flexibility which he needs to rule perfectly, and protect the varied dispositions of those entrusted to his care, must appear to him an ideal. The home, with all its relationships and customs, must become infinitely valuable to him, so far as it helpfully co-operates, and what is wanting he must miss, that he may learn to desire it. Thus begins the education of the true teacher."' Well would it be for all of us and for that profession which we would fain magnify could we attain to the ideal mapped out in the above eloquent words of the distinguished teacher. His letters to his pupils, written after he had left them, show how implicitly he believed in 'the good nature of healthy boys.' It was in 1799 that he resigned his post of tutor and hied himself to Bremen, where he spent the next two years in the study of philosophy, his direct object being the completion of his academic course, begun at Jena, but interrupted by his acceptance of the post of tutor in the Steiger household. Earlier in this self-same year he had visited Pestalozzi at Burgdorf, one result of which was his essay on 'Wie Gertrud ihre Kinder lehrt' (How Gertrude teaches her children), which Pestalozzi had just given to the world. His impressions on this point are thus given by Quick:—'Herbart, when he visited Pestalozzi at Burgdorf, observed that though Pestalozzi's kindness was apparent to all, he took no pains in his teaching to mix the *dulce* with the *utile*. He never talked to the children or joked, or gave them an anecdote. This, however, did not surprise Herbart, whose own experience had taught him that when the subject requires earnest attention the children do not like it better for the teacher's "fun."' His own words are as follows:—'My own experiences and experiments had prepared me to estimate the mental power of children incomparably higher than is usual, and to seek the reason of their pleasure in instruction elsewhere than in superfluous sporting, and their dislike of it elsewhere than in the assumed dryness and difficulty of such subjects as require seriousness and attention. What are considered the difficult and the easy I have found to be the exact contrary. *I have long held that the sole and genuine root of instruction is a feeling of clear apprehension.* And a perfect regularity in the sequence of studies adapted to all requirements was to me the ideal, which I looked upon as the omnipotent means of securing to all instruction its true efficacy. It was the discovery of this sequence, of the arrangement and co-ordination of what was to be learned contemporaneously and what consecutively, which formed, as I understood it, Pestalozzi's chief aim.' In a further essay on Pestalozzi's 'Idee eines A B C der Anschauung' (Notion of an A B C of the observation), he again emphasises the excellence of Pestalozzi's practice in the careful cultivation of the observing powers. 'Of all the formative processes of education, cultivated observation is the most important, both for the child and boy, for it lays the solid foundation of future knowledge and judgment. The child is made up of desires, perceptions, and imaginations. From perceptions follows knowledge of nature and of objects, and they must preponderate, unless the child is to be ruled by caprice, the outcome of desires, or by delusions, the growth of imaginations. Imagination needs guidance, the desires a counterpoise; both lend themselves to a keen observation of objects as they are, which means, in the case of children, as they are exhibited to them.' Did space permit, it would be easy to point out many resemblances between the ideas of these two great men. It must, perforce, suffice to state that Pestalozzi was without that knowledge of psychology which could enable him to see the true content of his principles and of the necessity for their extension beyond the range of elementary to the wider sphere of education in general. This no one saw more plainly than Herbart, and no one strove more earnestly or successfully to bring about the necessary enlargement of purview.

From Bremen, in May of 1802, Herbart went to Göttingen. Obtaining his Doctor's degree in the University of that ilk in open disputation, he soon

became lecturer in philosophy and pedagogy; nor did it require much time to demonstrate to the full how well the lecturer and the lecturing were suited to each other. Ere long the lecture-room of Herbart became the centre of Göttingen philosophic thought: furthermore, so convinced was the lecturer that he had found his true *métier*, and the natural sphere for its due performance, that he refused a call to Heidelberg, albeit by responding to it he had increased his salary fourfold. It may interest our readers to know that the princely salary enjoyed by the Göttingen professor was £45 per annum, and what other small sums he might earn outside his duties as lecturer. For seven years, in spite of much tribulation, resulting from the troublous times in which he lived, Herbart remained at Göttingen. At length he departed thence, and in 1809 succeeded to the chair of philosophy in the University of Königsberg, which had previously been held by the immortal Kant. 'How happy was I,' said he, 'to receive the offer of this, the most renowned chair of philosophy, the place when a boy I longed for in reverential dreams, as I studied the works of the sage of Königsberg.' Here again was offered the clearest proof of the fact that it was the educational side of his work that lay nearest to Herbart's heart. This appears in the following words:—'Amongst my duties I had the lectures on education very much at heart. *But education cannot merely be taught; it must be demonstrated and practised.* Besides, I wish to extend my 10 years' experiences in it. So I long ago conceived the idea of teaching a small number of selected boys myself for an hour daily, in the presence of some young men acquainted with my pedagogy, who will afterwards attempt in my place and under my eye to carry on what I have begun. *Gradually in this way teachers may be trained, whose methods must be perfected by mutual observation and exchange of experience.* Since a plan of instruction is worthless without teachers, and, moreover, such teachers as are inspired by the spirit of the plan and skilled in the use of method, perhaps a small experimental school such as I propose will be the best preparation for future and more extended movements.' Prussia backed up the Professor's efforts in a most gratifying way, giving him *carte blanche* with respect to his methods, and the choice of an assistant at an annual salary of 200 thalers.

Herbart was at one with Pestalozzi in believing that family life was the ground on which education ought to grow; therefore he hastened to get married in order that he might provide his pupils with a home. That he married an Englishwoman—Miss Mary Drake—cannot fail to engage the interest of Englishmen, who will rejoice likewise in the knowledge that 'their union seems to have been one of hearts and minds, Frau Herbart being true to the highest ideal of wifehood, "*wise, not that she might set herself above her husband, but that she might never fail from his side.*"' Later on more appreciation was experienced at the hands of the Government, who not only increased the Professor's stipend, but also appointed him Director of the Royal Examination Commission. Nor was the more precious public approval wanting, as was daily testified by the crowded state of the Professor's lecture-room, his students evidently regarding him as the most renowned teacher of his age.

The school to which reference was made above was turned into a training college, which flourished up to the time when, in 1833, Herbart was compelled by adverse circumstances to leave Königsberg, and which 'being dead, yet speaketh,' for upon its ruins have been built up many institutions which are avowedly conducted on Herbartian lines, one of the most successful being that at Jena, under the management of Professor Rein, to whose 'Outlines of Pedagogics' (Sonnenschein, 1893) the English reader should be referred who would desire more particulars of the Herbartian principles than are contained in the work translated by Mr. and Mrs. Felkin, to which such frequent reference has already been made in the course of this essay.

His second tenure at Göttingen was equally successful as the first. It was here that he wrote and published 'Umriss Pädagogischer Vorlesungen' (Sketch of Pedagogic Lectures), which ranks next to his 'Allgemeine Pädagogik' (General Pedagogy) in the list of Herbart's educational productions. On August 11th, 1841, he succumbed from a sudden stroke of apoplexy. Of him it may be said, in his own words, '*Whatsoever of morality and of intelligence; what of patience, perseverance, faithfulness, of method, insight, ingenuity, energy; in a word, whatsoever of strength the man had in him, will lie written in the work he does.*'

On his tomb are written these appropriate words:

'To penetrate the sacred depths of Truth,
To strive in joyful hope for human weal,
Was his life's aim.
Now his free spirit hath the perfect light,
Here rests his mortal frame.'

To attempt any adequate statement of Herbart's philosophy of education within the narrow limits of a magazine article would be to court inevitable defeat. We can only say that with him education meant the formation of character. As he was never tired of iterating and reiterating, 'education is not cram, but character'; and, as Professor Chas. de Garms rightly says, 'Character-building is will-building.' The first step, then, is a consideration of 'will,' and therefore Herbart holds that 'the good will alone has absolute value. The soul is a *tabula rasa*, whose only original power is that of entering *through the medium of the nervous system* into reciprocal relations with the external world. These relations supply the mind with its primordial presentations—the sensuous ones of sight, hearing, smell, taste, touch, pleasure, pain. . . . . The primordial presentations constitute, however, but a small part of the mind's contents; their interaction produces the derived presentations which in their varied development form the greater part.' The power which is connected with the nervous system varies in different individuals, and 'the teacher ought to make it a point of honour to leave the individuality as untouched as possible; to leave to it the only glory of which it is capable, viz., to be sharply defined and recognisable, even to conspicuousness.' The function of the teacher thus resolves itself into the giving of presentations and the development therefrom and thereby of mind: whilst leaving the individuality, the teacher will animate the mind with thoughts, feelings, and desires which it otherwise would never have obtained, which will powerfully influence the future development of the mind. In a word, the teacher will help the pupil to rise to

higher things from the vantage ground of its own inherent individuality, or, as Herbart says, in helping the pupil to *form his own character by his own power*, will 'place the power already existent, and in its nature trustworthy, under such conditions that it must surely and infallibly accomplish this rise.' 'The function of government is to restrain the wild impetuosity of childhood, which cannot be called will until such time as the true will, which renders the human being capable of self-determination, can grow up in its place. To form this will—in other words, to form the character—is the work of instruction and discipline combined' (Felkin). Again to quote Garms, 'Children have at first no real moral character. It arises gradually, and begins when here and there simple moral volitions arise from the union of similar acts of will.'

From the preceding remarks it is abundantly apparent that to Herbart *all education is moral education*, a view which common-sense endorses, and in accordance with which all practice which is defensible must be. Formation of character thus goes hand-in-hand with education, being in fact the one supreme test of education. Government, Instruction, and Discipline are the three divisions of education. The first of these creates order; the second has for its more immediate aim the creation of a many-sided interest, whilst the third comprises the 'direct action on the child, with intent to form him.' . . . . . 'The aim of discipline is *moral strength of character*, that is, steadfastness in progress to virtue.' Advance must always be made in the direction of self-dependence on the part of the child. 'In proportion as the pupil has gained trust in his opinions and principles, discipline must retreat and allow room for self-education.' For Herbart his translators claim that 'he saw, and was probably the first to do so, clearly *three* things, and their intimate connection: first, that there can be but one right method of education, and its foundation is psychology; secondly, that this method is infallible, can and must claim for itself certitude; and thirdly, that virtue, the end and aim of all education and life, has an impregnable basis in the human mind, and can claim for itself certitude also.'

A few isolated details of opinion must bring this prolix narrative to a close. 'I have no conception of education without instruction, just as conversely I do not acknowledge any instruction which does not educate.' 'The intent to teach spoils children's books at once. . . . . Show the children the bad plainly, but not as an object of desire, and they will recognise that it *is* bad. Interrupt the narrative with moral precepts, and they will find you a wearisome narrator.' 'But nothing can destroy my hope that the good-natured and healthy boys are not to be considered such rarities, but will stand the greater number of educators in good stead, as they stood me.' 'Perhaps it has been my misfortune to witness too many examples of the effect of strict supervision in public institutions, and perhaps, having due regard to safety of life and strength of limb, I am too much possessed with the idea that *boys and youths must be allowed to run risks if they are to become men*. Suffice it briefly to remember that punctilious and constant supervision is burdensome alike to the supervisor and those he watches over, and apt to be associated on both sides with deceit.' 'From those who grow up under the oppression of constant observation, no versatility, no inventive power, no spirit of daring, no confident demeanour can be expected.' 'Love depends on the harmony of the feelings and on habit. He who secludes himself, who speaks much in hard tones and becomes excited about trifles, will never gain it; nor, on the other hand, will he who makes himself familiar, who, when he should be kind, and yet at the same time maintain his ascendancy, seeks his own pleasure by taking part in the enjoyment of the children. Either the teacher should enter into the feelings of the pupil, and without permitting it to be noticed, joins in them with tact, or he takes care that the pupil shall approach him in a particular way.' 'Very few natures pass of themselves out of the shallowness which constitutes what we call commonplace; and, except as imparted to them, fewer still attain to that spirit of discrimination whose work is to cultivate within and without.' Many other extracts which we had marked must be omitted. In conclusion, by way of reason for demanding of our readers the study of such thinkers as Herbart, who do not give 'rules of thumb,' but who seek the reasons for rules even to the very foundations of thought, we give the following aphorisms: 'Modern life in all its departments is ruled by experts and by those who have attained the mastery that comes by concentration' (Professor Hall, Worcester, Mass.). Again, 'Every one is aware how those who want to cultivate any sense or endowment in themselves must be habitually conversant with the works of people who have been eminent for that sense, must study them, catch inspiration from them; only in this way can progress be made' (Matthew Arnold).

NOTES ON PHYSIOLOGY:

EMBRACING THE SYLLABUS (ADVANCED AND HONOURS STAGES) OF THE SCIENCE AND ART DEPARTMENT.

BY WALKER OVEREND, M.B. (OXON.), B.SC. (LOND.).

90. *The functions of the liver*, other than the secretion of bile, may be studied either (*a*) by comparing the composition of the blood entering with that leaving the liver, or (*b*) by rapidly removing the liver of an animal just killed, placing it in a warm chamber, and circulating through the liver (by means of a glass tube tied in the portal vein, and another placed in the hepatic vein) different fluids or blood containing various substances.

91. The greater part of the proteid of food enters the blood as albumin, and is carried as such to the liver and tissues of the body at large. The nitrogen of the proteid molecule leaves the body chiefly, that is, in mammalia and man, as urea. Now urea (CON_2H_4) exists in the blood in the constant proportion of 0·02 per cent. It is also present in the lymph and chyle, and in all the tissues except those of the brain and muscle. When any body containing an ammonia-grouping, as ammonium chloride, carbonate, citrate, is given to animals, it passes out of the body as urea. This process takes place in the liver, for if blood containing ammonium carbonate is circulated through a liver removed from an animal just dead, the percentage of urea in the blood leaving the liver is increased. In fact, everything tends to the probability that urea is chiefly produced in the *liver*, and that it is there constructed from some body, or bodies, containing ammonia-groupings.

92. *Glycogen.*—On examination of a decoction of liver, Claude Bernard, in 1856, discovered a body resembling starch which he called glycogen. This substance is a carbohydrate, and has the composition $C_6H_{10}O_5$. Since that time glycogen has been proved to

exist in all growing tissues, also it is present in white corpuscles, in the spleen, etc. But it is found in greatest amount in the liver and in the muscles.

93. When a rabbit is fed on carrots for a few days, and killed, the liver quickly cut out, sliced, and thrown into boiling acidulated water, boiled for about 15 minutes and filtered, the filtrate contains glycogen in solution. By adding alcohol the glycogen may be precipitated and separated. Similarly, under the microscope, pieces of liver finely teased will show the hepatic cells, and the presence of glycogen within them may be demonstrated by means of a solution of iodine. In the hepatic cell of a frog, during the winter months, we can recognise (*a*) oil globules, (*b*) proteid granules, and (*c*) a material in the outer part of the cell which stains port-wine red with iodine, and is glycogen. If the frog be abundantly fed on carbohydrate food the cell contains a larger amount of glycogen than normal. If fed on proteid material, as fibrin, the liver contains little or no glycogen, the cells are smaller, and give no port-wine coloration with iodine. In the summer months the liver of the frog contains little or no glycogen. Similar changes occur in rabbits. If fed on carbohydrate food the cells are large and loaded with glycogen; if fed on fibrin there is but a minute quantity of glycogen; if the rabbit be starved there is no glycogen at all. If the liver of the rabbit be not thrown into boiling water at once, but allowed to stand several hours, it contains little or no glycogen, but it contains *dextrose*. The liver cells do not die immediately, and as a result of their activity during the short time they remain living, they convert the glycogen into sugar. The boiling water kills them and preserves the glycogen.

94. Evidently the amount of glycogen present in the liver at any moment depends principally on the quality of the food ingested. Of the three principal food-stuffs the albuminous bodies and the fats exert little or no influence on its production, but the carbohydrates induce a storage of the substance within the hepatic cells. Besides this heavy, muscular work diminishes the amount in the liver.

95. If the medulla of the rabbit be injured by a needle in the area of the vaso-motor centre, after about 24 hours the urine is found to contain sugar. If the animal be starved previously, no sugar passes into the urine. In this experiment, therefore, glycogen obviously is the source of the sugar. The glycogen of the liver in the first instance is rapidly converted into dextrose, which passes into the blood, and thence into the urine. Normally the blood of man contains about 0·1 per cent. of sugar, but if by any reason the amount rises to 0·3 per cent., the excess is separated by the kidneys and passes out of the system. Certain poisons, as curare, arsenic, strychnine, etc., induce a temporary *diabetes* of a similar nature. In the disease known as diabetes, the patient passes large quantities of sugar in the urine. It appears that there are several forms of the disease. Sometimes the cause lies in a loss of power on the part of cells to convert the sugar reaching it into glycogen: so that the sugar ingested with the food passes on into the general circulation, and reaching the kidney is separated; and the obvious treatment here is to limit the carbohydrates taken in with the food. In other cases such a limitation of carbohydrate has no influence in checking the disease. We know that the liver has the power of splitting up proteids into two parts, one containing the nitrogen which ultimately leaves the body as urea, and a second which is partly converted into sugar. This passes into the system in small quantities at a time, and is utilised by the various tissues as a source of energy. Where the prohibition of carbohydrates does not check the disease, it seems that the tissues of the body at large are at fault, and are unable to appropriate the sugar formed in the liver. In some instances the pancreas is also diseased, and extirpation of the pancreas in dogs is followed by a fatal diabetes.

96. *Lymph and Chyle.*—The lacteals of the intestine become filled during digestion with chyle, which they convey to the thoracic duct. Both lymph and chyle contain lymph corpuscles, which appear to be identical with white corpuscles, and they also exhibit amœboid movements. Besides these corpuscles, chyle contains a large number of exceedingly fine granules which on treatment with acetic acid run together to form larger droplets. These are fat granules. Lymph and chyle contain the same substances as blood-plasma, viz., fibrin factors, fat, lecithin, salts, and extractives. Lymph contains about 5 per cent. solids, proteids about 3, consisting of fibrinogen, serum albumin and globulin, also traces of sugar, fat, and urea. Lymph also contains gases in solution, namely, oxygen, nitrogen, and carbon dioxide. The quantity of carbon dioxide amounts to about 90 per cent. of the whole, while the quantity of oxygen is very scanty. Chyle differs from lymph chiefly in containing a much larger quantity of fat. It often contains as much as 5 per cent., making a total of 10 per cent. solids.

97. In all parts of the body, except in the spleen, the blood occupies definite channels, and is thus separated from the cells of the tissues by the capillary wall. The spaces between the fibres and cells of the tissues are occupied by a fluid which exudes through the capillary wall of the blood vessel, which is termed *lymph*. The lymph, therefore, bathes and brings nourishment to the tissues. The spaces already mentioned are termed *lymph-spaces*, and they are lined by a layer of flat cells. All the spaces communicate with each other, and they convey their contained lymph into minute lymph capillaries which unite with others to form larger lymphatic vessels, and finally end in the thoracic duct. In their course they pass through lymphatic glands, and the lymph transudes slowly through them, carrying with it lymph corpuscles, which become white blood corpuscles in the blood vessels.

98. By tying a small tube in the thoracic duct, a supply of lymph may be obtained. It is alkaline and watery when the animal is fasting, but during digestion the fluid is milky, from the fat particles (chyle). The flow of lymph is increased during digestion and muscular exercise. Certain substances also exert a remarkable increase in the flow. They are called lymphagogues. Some increase the flow by increasing the exudation from the blood capillaries, as a watery extract of crab's or lobster's muscles, also peptone acts similarly. Other bodies extract water from the tissue elements themselves, and so make the lymph more watery and increase its quantity. Such are sugar and neutral salts. If cray-fish extract be injected into the veins of an animal, after a few minutes the flow begins to increase, and may reach ten times the previous amount, and the lymph at the same time contains a greater percentage of solids. The cray-fish extract is a substance which excites the endothelial cells of the capillary wall to *secrete* larger quantities of a more concentrated lymph. The lymph flowing from any part has a two-fold origin—(*a*) from the blood; (*b*) from the tissues. The part from the blood is separated by means of the living cells of the capillary blood vessel.

99. *The Renal Circulation.*—The structure of the kidneys and their functions have been described in 'Elements of Physiology,' by the Author. The renal artery, a branch of the aorta in the abdomen, enters the *hilus*, and breaks up into branches which pass between the *pyramids*. At the bases of the pyramids they form arches which again send branches backwards to the *medulla*, and forwards to the *cortex*. The latter are called interlobular arteries. Each sends a branch to a Malpighian capsule, the arrangement of which is described in the text book just mentioned. As the renal artery passes to the kidney it is surrounded by a fine plexus of nerves, derived from the solar plexus.

100. Normal urine is a yellowish, clear, and acid fluid; the specific gravity is 1·02. It contains urea, uric acid, kreatinin, hippuric acid, and salts, viz., sodium chloride, potassium and sodium sulphates, and certain earthy and alkaline phosphates. If we tabulate the amounts of each excreted during the twenty-four hours, we find—

Water	1500 grammes (1½ litres)
Urea	33 ,,
Uric acid	½ gramme
Hippuric acid	1 ,,
Kreatinin	½ ,,
Sodium chloride	12 grammes
Potassium and sodium sulphates	4 ,,
Phosphates	4 ,,

that is about 1500 grammes water per day, and 57 grammes total solids. The urea is the most important body. It represents the form in which N leaves the body. Uric acid is the chief nitrogenous excretion in birds and reptiles. Hippuric acid seems derived from benzoic acid. When the latter is given to healthy individuals the hippuric acid of the urine is increased. Kreatinin is derived from the kreatin of flesh. The amount of sodium chloride varies with the store of chlorine within the body.

101. According to the late Sir William Bowman (1842), the water and salts are separated from the blood in the Malpighian capsules, while the epithelium of the tubules secretes the specific constituents, viz., urea, uric and hippuric acids. Thus the renal tubules form a glandular apparatus. He speaks of the capsules as a 'wonderful apparatus, aiding in the washing away of the products of the activity of the cells of the tubules.' Ludwig (1844) thought the whole constituents of the urine filtered through the capsules, but that the urine was concentrated by the absorption of water during the passage through the renal tubules. The excretion of water is certainly to some extent dependent on the pressure of the blood within the arterial tufts of the capsules, and the greater the pressure, the greater the amount of water filtered through into the tubule. Certain facts are in favour of Bowman's theory. (1.) In birds the capsules are always free from uric acid, even if the ureter be ligatured, while the epithelial cells of the convoluted portion of the tubes contain uric acid in the form of granules, but not that of the straight tubes.

(2.) In rabbits we can gain evidence that the cells of the tubules participate in the act of secretion. Sulphindigotate of soda (indigo-red), when injected into the veins of the neck, and the animal killed after ten minutes, is found in the cortex of the kidney, and colours the whole of it blue. Moreover, there are certain insuperable objections to Ludwig's theory.

102. Urea is not only excreted by the tubules after ligature of the renal artery in frogs (where the capsules only are supplied by this vessel, the tubules being supplied from another source), but carries with it, in the process, a considerable quantity of water.

103. Injury to a certain part of the medulla oblongata induces a large secretion of watery urine—polyuria. The injury induces a dilatation of the renal blood vessels, raises the arterial pressure in the glomerate, and increases the secretion of water. In the discharge of water, the skin and kidneys act in a complementary manner. On a cold day the skin is pale, its arteries are constricted, while the blood vessels of the abdominal viscera, including the kidneys, are dilated. There is an increased and quickened flow of blood through the capsules, and an increased secretion of urine. The converse happens in hot weather. The mere drinking of water does not necessarily increase the flow of urine. Alcohol, and certain substances, like sodium acetate, potassium nitrate, spirits of sweet nitre, increase the flow of urine by dilating the blood vessels of the kidney. There are no secreting nerves in the organ; the nervous system can only influence the secretion of urine by constricting or dilating the blood vessels. The vasomotor nerves of the kidney pass through the anterior roots of the lower dorsal spinal nerves, and when these are stimulated the kidney shrinks in volume, since the quantity of blood within it becomes less.

104. *The Skin* consists of an epidermis resting on a layer of connective tissue called the Dermis. (See 'Elements of Physiology,' by the Author.) Two forms of gland are met with,—*sweat* glands and *sebaceous* glands. The latter open into the follicles or pits in which the roots of the hair are imbedded. Sweat, the production of the sweat glands, is a clear, colourless liquid, with a salt taste, and alkaline reaction at first. It often becomes acid from contamination with fatty acids from the oil secreted by the sebaceous glands. It contains about 1 per cent. solids, of which sodium chloride forms the essential part. Traces of fatty acids are also present, and under certain circumstances urea and sugar. It also contains a trace of CO^2.

105. The secretion of sweat is constant. If only a small amount is formed, it is at once evaporated, and goes off into the atmosphere without being perceived (insensible perspiration). If the amount be larger, it collects on the skin and becomes visible (sensible perspiration).

106. As a general rule the act of perspiration is accompanied by a dilatation of the vessels of the skin, but these two things are quite independent, as in the case of salivary glands. When the sciatic nerve of a cat is divided, and the lower end stimulated by an electric current, the soles of the feet become red and drops of sweat appear on them. If the artery of the leg be tied with a ligature, so that no blood passes to the sole, and the sciatic be again stimulated, drops of perspiration appear just as before. The fact that perspiration may be free when the skin is nearly bloodless, as in the agony of death, also supports the view that there are special nerves passing from the central nervous system whose business it is to control and regulate the secretion of sweat. Sweat centres exist in the medulla oblongata and in the spinal cord. Certain drugs act on these centres, as nicotin and acetate of ammonia; others act locally, as pilocarpin, the alkaloid of jaborandi.

107. The functions of the skin therefore are:—

(1) To act as a regulator of the discharge of heat from the body. (*a*) Dilatation of the blood vessels of the skin is followed by a greater loss of heat. (*b*) Further, if the secretion of sweat be very copious, its evaporation again means a loss of heat. Nearly 80 per cent. of the total heat-loss of the body is effected by the skin. The regulation of this loss is accomplished by means of the vasomotor nerves and the secreting nerves of the sweat glands.

(2) The skin is also useful as an organ of sense. By its means we distinguish sensations of heat, cold, pain, and touch. The last seems to depend on the touch-corpuscles. (See Text-Book, by the Author.)

Questions set at the Science and Art Examination.

1. Describe the structure of the liver, both as seen with the naked eye, and when studied by the help of the microscope. What are the uses of bile in digestion? What purpose is served by the gall-bladder? (*Advanced*, 1880.)

2. Give an account of the structure of the skin. What are the chief characters of perspiration? What circumstances determine the amount of perspiration secreted? (*Advanced*, 1880.)

3. State the essential difference between venous and arterial blood. Explain the manner in which venous blood becomes arterial, and arterial blood venous, in the body. (*Advanced*, 1881.)

4. Describe the structure of the pancreas. What changes occur in the pancreas some time after food has been taken? State the nature and composition of pancreatic juice and the changes it effects on food. (*Advanced*, 1887.)

5. Describe the structure of a villus in the small intestine. Explain the part played by a villus in absorbing digested food. (May, 1886.)

6. State what can be made out concerning the structure of an ordinary nerve, as the sciatic, *without* and *with* the aid of the microscope. (*Advanced*, 1885.)

7. Describe the muscular movements which take place in ordinary quiet respiration. Explain how these movements lead to the entrance of air into, and exit of air from, the lungs. How are the movements changed when by obstruction in the trachea or otherwise the air is prevented from passing into or out of the lungs? (May, 1893.)

8. How does the structure of the mucous membrane of the large intestine differ from that of the small intestine? What changes does ordinary mixed food undergo in the small and in the large intestine respectively? How are these changes produced? (May, 1893.)

9. In what form is nitrogen taken into the body, and in what form and by what means does it chiefly leave the body? How and where is the change from the one form to the other brought about? (May, 1893.)

10. Describe the position, shape, and arrangement of the ossicles of the ear. How do they work in conveying sound from the exterior of the body to the internal ear? Where and by what structures is sound finally made to produce an effect on the nerve of hearing? (May, 1893.) (See 'Elements of Physiology,' published by Hughes. 2s. 6d.)

11. Describe the structure of the kidney, including its blood-vessels, and enumerate the most important constituents of the urine. What influences increase the amount of fluid secreted? (May, 1881.)

12. Give a general account of the structure of the tongue, with a special description of its mucous membrane and the structures found therein. With what nerves is the tongue supplied, and what are the functions of each? (May, 1882.)

13. Describe the structure of the iris. What circumstances lead to a widening and what to a narrowing of the pupil, and how? (*Advanced*, 1882.)

TEACHERS' DRAWING LESSONS.

FREEHAND.

STANDARD V.

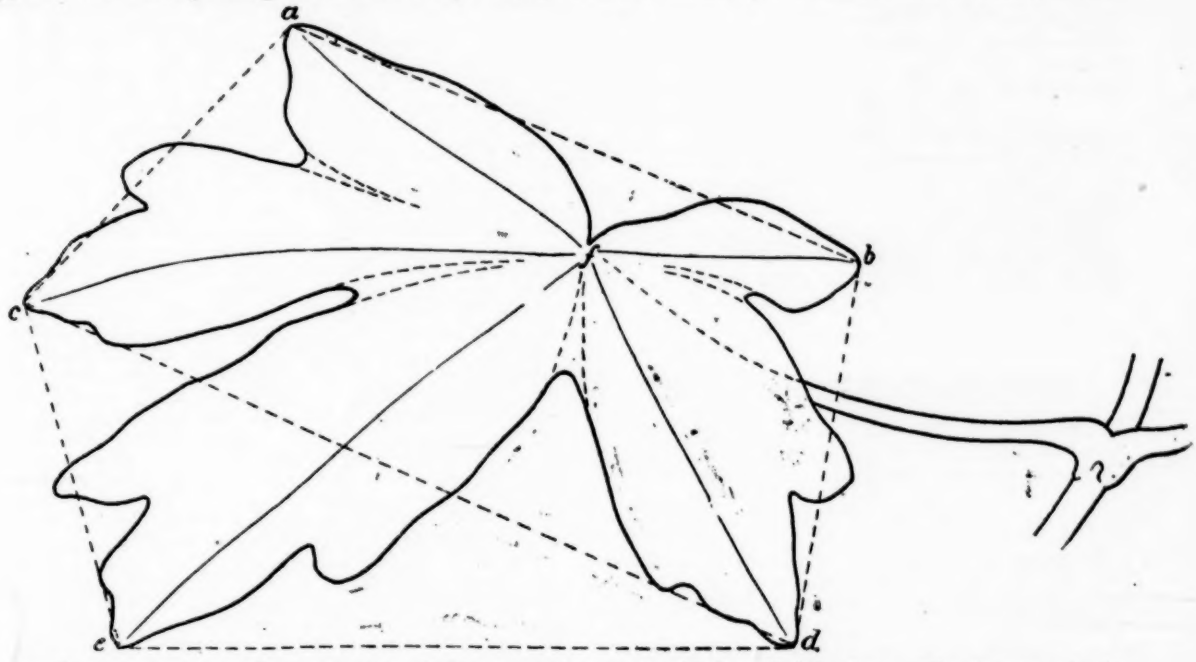
BY E. BUFFERY RIDGE,
Art Master under the London School Board.

Fig. 6. A Maple Leaf. Examination Copy often used by H.M. Inspectors.

Set out first the four-sided figure *abcd*, making *ab* and *cd* parallel, and the distance between them less than half of *cd*. Make the angle at *c* rather sharper than the corresponding angle at *d*, so that *cb* shall equal *cd* and be longer than *ad*. Fix the point *e* by looking well at the shape of the triangle *cde*—be careful especially about the distance of *e* from *cd*. Compare *ab*, *ae*, and *ed*, also *ac*, *ce*, and *bd*. Mark *f*, the most important point in the copy, by noting its distance from lines *ab* and *cd*, and from corners *a* and *b*.

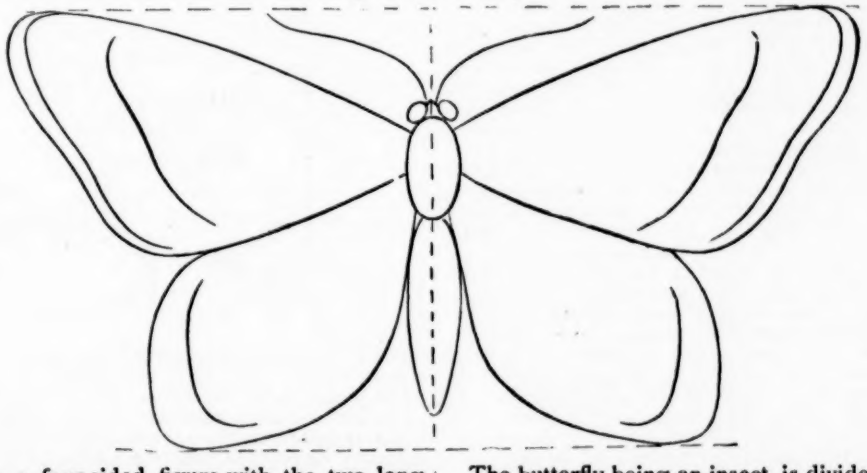
All parts of the leaf grow out or radiate from *f*. Draw the veins, from *f* to the five corners—*bf* nearly in line with *fc*, *fe* and *fd* nearly straight.

Fix the positions of the four deep notches separating the leaf into finger-like lobes. Begin the outline at *a* by drawing the curve which bends round to *f*, then the corresponding curve from *b* to *f*. Now just as these two lines spring out as radiating lines from *f*, so do all the other parts of the outline. From *a* draw the curve to the first notch in such a manner that, as shown by the dotted line, it would, if continued, run on to *f*. Proceed with all the large notches, making every curve radiate from *f*. Treat the small notches in the same way, keeping the principle of radiation always in mind. Do not make the corners too sharp. The direction and curve of the leaf-stalk is shown by the dotted line from *f*. Pay attention to the thickness of the leaf-stalk as compared with the portion of the twig, and with regard to the latter, be careful to make the upper part agree with the lower in direction, while its thickness should be slightly less. The leaves of the maple grow in pairs, each leaf having another opposite to it on the twig; a piece of the stalk of this opposite leaf is shown, and the peculiar thickening of the bases of the leaf-stalks as they wrap round the stem should be carefully drawn.



In outlining this copy, do not attempt to make very fine lines. Hold the pencil two inches from the point, and swing the hand freely to follow the curves, turning the paper to bring each line into a favourable position.

Fig. 7. A Butterfly.



Enclose in a four-sided figure with the two long sides parallel, similar to *abcd*, Fig. 6. What is the relation between length and breadth in this example?

The butterfly being an insect, is divided into three parts: head, thorax, and abdomen, and it is to the second division, or thorax, that the legs and wings are attached. Draw the central ellipse of the figure

representing the thorax, then the lower part, then the head with the two ellipses for eyes. Take care that the axes of the ellipses (or eyes) are equally inclined towards the centre line, otherwise the butterfly will *squint*.

Draw the edges of the wings, radiating from the centre ellipse, and the two feelers springing from the head. The lower edges of the upper wings, if continued through the body, will run parallel to the upper edges, and the lower edges of the lower wings, continued, will run upwards and across, and be carried on by the feelers. In drawing the curves inside the wings, look on them as edges of other wings, smaller, but similar in shape to the real wings.

Line in freely, with sweeping curves as in the last copy; but as this figure is symmetrical, greater care will be wanted in balancing the two sides.

CONVERSATIONAL LESSONS IN CHEMISTRY.

BY THOMAS CARTWRIGHT, B.A., B.SC.(LOND.),

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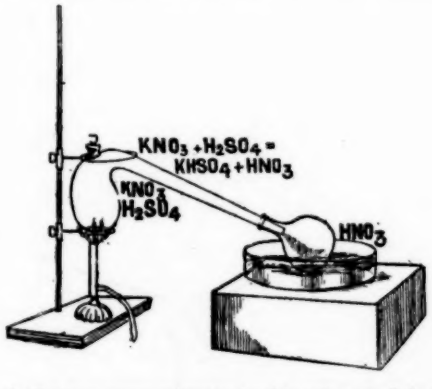
For particulars of the List of Chemicals and PRACTICAL TEACHER Set of Apparatus for working the experiments referred to in these lessons see numbers for January and February 1893.

LESSON XIII.—SOME COMMON ACIDS.

The term acid we have made frequent use of in our former lessons. To-day we intend to study the commonest of these bodies in order to see what their most important properties are. What acids can you name, Trixie? Sulphuric, Hydrochloric, Nitric and Carbonic. Yes: what do you wish to say, Tom. If we speak of common acids, sir, must we not include vinegar? Certainly, we must; and the acid which vinegar contains is called acetic acid. Citric acid and tartaric acids, again, are common acids that are found in nearly all fruits. They are of great importance, as it has been found that the body does not keep in good health without them. In fact, that dreadful disease, scurvy, is likely to fasten itself on people who abstain from fresh fruits and vegetables, which contain these acids, and that is why fruit is so generally eaten.

In anticipation of this lesson I have prepared specimens of all the acids that you have named. Here they are, and I wish you to tell me what you think worth saying about them. Classify them in any way you think best. Well, Bob, we will listen to you. Some of them are solid, as tartaric and citric acids. Some are liquid, as sulphuric and nitric acids, and some are gases as hydrochloric. Quite right, and you see that the state of the body as to whether it is a solid, liquid, or a gas, has nothing whatever to do with the acidic properties. Now, Frank, you speak. Some have oxygen in them and some have not. Right, but how could you prove that? If we take Cl and H and bring them together, hydrochloric acid is formed; and this, therefore, has no oxygen in its composition. If we add water to sulphur trioxide (SO_3). sulphuric acid is formed; which, of course, has O in its composition. Yes, and you have drawn attention to a rather important point to which I shall refer again shortly. At present, remember, please, that, according to this point of view, we divide acids into *oxyacids* like H_2SO_4, and *hydracids* like HCl. Most acids belong to the former of these two classes. Now it is your turn, Laura. All acids contain hydrogen, and we have learnt that this H can be replaced by metals, as when we prepared H by the action of zinc on H_2SO_4. True, and now I may tell you that for a long time it was thought that all acids must contain O, and that to the presence of this O was due the special qualities which all acids possess in common. When, however, it was discovered that hydracids existed, this view was abandoned, and we now believe that it is the presence of H which gives the peculiar power to acids.

Once again we will enumerate the qualities which distinguish acids from other bodies. You shall do this for us, Annie. All acids are sour. Yes, we will admit this, although it is not absolutely true. All have the power of turning blue litmus red. All have H, which can be displaced by a metal, and all decompose carbonates causing CO_2 to be given off. Quite right, and you shall proceed to prove this to be true with respect to the acids which we have now under examination. Now this has been done we will proceed to examine our specimens individually. First, let us take H_2SO_4, which has been aptly termed the King of Acids, on account of the many uses to which it is put. It is nearly twice as heavy as water, for which it has great affinity, as you can see by the seething which follows the contact between water and the acid. On this account we use the acid for a special purpose. What is this purpose? See, here is some calcium chloride that you saw me put under this bell-jar, together with a saucer containing some strong H_2SO_4. What difference do you notice, Ernest? The calcium chloride is quite dry now, sir, and I think the acid must have taken away the moisture. You are right, H_2SO_4 is a drying agent. Into a test tube of sulphuric acid I pour a solution of sugar, and you see that it turns black. Can you guess why? Suppose that sugar is C, H, and O, and that the H and O are present in the proportion needful to form water. What is the colour of carbon? Ah, now you have it; but think carefully, and then let Arthur tell us what he makes of the question. I think, sir, that again the H_2SO_4 extracts the O and H, and leaves behind the C, which causes the black colour. You are right. Next I wish you to observe the acid in this beaker, which also contains a thermometer. When the acid boils, take note of the boiling point. You shall tell us, Annie, exactly what this is. Now it boils, sir, and the thermometer is at 340°. That is near enough, as the exact figures are 338°C. What is the boiling point of water, Tom? 100°C. Yes; so that H_2SO_4 has a high boiling point compared with water. Now take a flask, Minnie, and fit it up with thistle funnel and leading tube. Place some common salt in the flask, pour some H_2SO_4 carefully down the funnel; heat and collect by downward displacement of air. Dip a rod in ammonia, and then plunge it into the jar. Tell me what you notice. Dense white fumes are at once produced. Yes, they are ammonium chloride, so the gas got from salt and sulphuric acid was hydrochloric acid gas. $NaCl + H_2SO_4 = NaHSO_4 + HCl$. Now



James shall place some saltpetre in this retort, and then pour in some H_2SO_4. The liquid that collects in the cooled receiver is nitric acid. In each case the strong H_2SO_4 has expelled the other acids from combination, which is just what H_2SO_4 will do to most compounds of other acids, proving how exceedingly strong it is. From this it follows that it may be used in the preparation of other acids, and indeed nitric, hydrochloric, acetic, and many other acids are prepared best in this way. You can now see why the acid is so important. Hundreds of thousands of tons are produced every year. It is used

in soda-making, from which again soap and glass are obtained. There is scarcely a single chemical manufacture in which H_2SO_4 does not play an important part.

Here is some nitric acid. What colour is it, John? Brown, sir. Well, you are wrong; for the brown colour is not due to the pure acid, but is caused by the decomposition of some portion of it. Does not that show, sir, that the acid is easily decomposed? Yes; and for this reason it acts as an oxidising agent, as one of the products of its decomposition is oxygen. Place this copper strip in the acid. See how easily it is dissolved. That, again, is usual with metals when placed in nitric acid, hence we say it is a highly corrosive acid. Put some copper in H_2SO_4 and heat it, Willie. Can you smell anything? Yes, sir; I can smell burning sulphur. That is to say, you can smell something that is formed when S burns: what is that something, Laura? Sulphur dioxide, sir.

Sam, here are two tubes—one containing H_2SO_4, the other HNO_3. How can you distinguish between them? Surely you do not hesitate. Oh, I see, the copper will do it, will it not, sir? Try. That is right. If I were to place some gold in HNO_3, it would not be attacked, and the same applies to platinum and a few other metals, which for this reason are called the 'noble' metals. HNO_3 is not so heavy as H_2SO_4, being 1½ times as heavy as water. Now let us finish by examining a solution of HCl. Whilst we have been talking the gas has been dissolved uninterruptedly by the water. None has escaped. Hence it is a very soluble gas. In a pint of water it is possible to dissolve 500 pints of HCl. How could you prove that it was HCl, Laura? Think of what we did in the playground! Got chlorine from it, sir, by heating it with manganese dioxide. Exactly so. Here are some zinc and some iron. Place them in a test tube of HCl, and what will happen, Bob? H will, in each case, be given off, and the metals will be dissolved. Quite true, but HCl will not dissolve nearly so many metals as HNO_3.

If we make a mixture of 3 parts of HCl and one part HNO_3, we get a liquid which readily dissolves both gold and platinum. What is the name given to this mixture? Aqua regia, sir. Quite right; and the name means 'the King of liquids,' as it is such a powerful solvent.

Of carbonic acid we simply say that it has never been obtained out of solution, being so unstable; that upon attempting to separate it from the water in which it is dissolved, it immediately decomposes into H_2O and CO_2. I think I have on a previous occasion told you, that from each acid, by displacing its H by a metal, we get a number of bodies which are neutral to litmus, to which the name salt is given. On the board you will see a number of these bodies shown in relation to the acid from which they are derived.

Acid.	Formula.	Name of salts.	Example.	Name.
Sulphuric - -	H_2SO_4	Sulphates	$MgSO_4$	Epsom Salts
Hydrochloric -	HCl	Chlorides	NaCl	Common Salt
Nitric - - -	HNO_3	Nitrates	KNO_3	Saltpetre
Carbonic - -	H_2CO_3	Carbonates	$CaCO_3$	Chalk

THE musical advisers of Messrs. Curwen & Sons have at length completed the examination of the compositions sent in by elementary school teachers in the Prize Competition recently advertised in our columns. They report that not only has the number of entries been surprisingly large, but the quality of work shows a high standard. The whole of the prizes offered in the eighteen classes have been awarded, and, in addition, over one hundred candidates have received honourable mention. The full list of awards appears in the MUSICAL HERALD for May.

OUR PUPIL TEACHERS' COURSE.

I. (*a*) Many Pupil Teachers to be examined in October next are greatly exercised in mind with respect to their History and Geography. It will save us much correspondence if it be borne in mind that the alterations in the above-mentioned subjects will not come into force until the 1895 examinations.

(*b*) Pupil Teachers for 1895 Examinations should note that Mathematical Geography, and what we may call Physiographical Geography, is not prescribed for them.

(*c*) (α) The Geometrical Drawing cannot now be taken at the candidate's school, but must be attempted at the May examination only.

(β) 'Light and Shade,' an additional subject, can be sat for at school.

(γ) Pupil Teachers cannot be examined *in the same subject* both at their own schools and at the May examination *in the same calendar year.*

(*d*) IN NEEDLEWORK there are the following alterations:—

(α) *First Year.*

(1) A hole correctly mended in stocking-*web* material.

(2) *A whipped frill* is added.

(3) The paper patterns are to be of *a small night-gown and a woman's cooking apron.*

(4) *The sock* is omitted.

(β) *Second Year.*

(1) The infant's night-gown or child's frock *need not now be in mull muslin or print.*

(2) The cutting-out may be by means of *folding and proportion.*

(3) *A knitted sampler showing the intakes at the back of a stocking, the turning of a heel, and the decreasings and finishing-off of a toe.*

(4) *The stocking* is omitted.

(γ) *Third Year.*

There are no alterations.

II. MODEL ANSWERS TO ENGLISH OF EXAMINATION, 14TH APRIL, 1894.

(i.) BOYS AND GIRLS.—THIRD YEAR.

1. (*a*) Paraphrase the following extract, and (*b*) explain separately the meaning of the words printed in italics:—

SPRING.

'Newborn flocks in *rustic* dance,
Frisking ply their feeble feet;
Forgetful of their wintry *trance*
The birds his presence greet:
But chief the skylark *warbles* high
His trembling *thrilling ecstasy*,
And *lessening* from the dazzled sight
Melts into air and *liquid* light.'—*Gray.*

(*a*) Young lambs with weak limbs uncouthly run about in frolicsome mood; and the birds, unmindful of their wintry torpor, welcome in the spring. Most of all the skylark, soaring aloft, rapturously trills his glad notes, and gradually vanishing from the bewildered eye, disappears in the sky amidst the softened sunbeams.

(*b*) *rustic* = country, uncouth.
frisking = frolicking, sporting.
trance = dullness, torpor.
warbles = sings sweetly as a bird.
thrilling = penetrating.
ecstasy = rapture.
lessening = appearing smaller.
melts = gradually vanishes.
liquid = mild.

2. (*a*) Analyse the following passage, and (*b*) parse the words printed in italics:—

'*What* was the real ground of the quarrel between Gray and Walpole *when* abroad, I do *not* know; but have *reason* to believe that it was of *too* deep a nature ever to be eradicated from Gray's bosom; *which* I gather from certain expressions half dropped *to* Mr. Robinson.'

(*a*) ANALYSIS.

Sentence.	Kind of Sentence.	Subject.		Predicate.		Object.	
		Simple.	Enlargement.	Simple.	Extension.	Simple.	Enlargement.
A. What was the real ground . . . ? do not know.	Principal.	I		do know	not	what was the real . . . when abroad	
A (2). What was the real ground. . . . when abroad.	Noun gov. by *do know.*	What		was the real ground	of the quarrel . . . abroad		
B. but have reason to believe . . . . . from Gray's bosom.	Principal, adversative to *A*.	[I]	(but)	have		reason	to believe that it was of . . . bosom
B (2). it was of too deep a nature even . . . bosom.	Noun, gov. by *to believe.*	it		was of too deep a nature	ever to be eradicated . . . bosom		
C. which I gather from from . . . Mr. Robinson.	Principal.*	I		gather	from certain expressions. . . . Mr. Robinson	which	

* This sentence is not strictly Adjectival, as *which = and this.* The usage is borrowed from the Latin.

(*b*) *What* Indef. pro., sing., 3rd, neut., nom., subj. to *was.*
when Adv. of Time, mod. *abroad.*
not Neg. adv., mod. *know.*
reason Com. noun, sing., 3rd, neut., obj., gov. by *have.*
too Adv. of degree, mod. *deep.*
which Rel. pronoun, sing., 3rd, neut., obj., gov. by *gather.* Its antec. is all the sentences *A* and *B*. Really it equals a Conjunction and Demonstrative.

3. (*a*) What do you mean by 'Verbs of Incomplete Predication?' (*b*) Give an example, and analyse the sentence which contains it.

(*a*) 'Verbs of Incomplete Predication' are differently defined by different grammarians. Taking the broadest view, they are those which—

(1) are copulative, such as *be, seem, appear,* etc., and

(2) are transitive and require a 'completion of predicate' or an object.

Thus intransitive verbs (excluding copulatives) are of complete predication.

(*b*) (1) *I am strong.*
I Pers. pron., sing., 1st, com., nom., subj. to *am.*
am Verb, irreg., intrans, copul., indic., pres., sing., 1st, agreeing with subj. *I.*
strong Adj. of quality, posit., qual. *I* predicatively.

(2) *John baptised disciples.*
John Prop. noun, sing., 3rd, masc., nom., subject to *baptised.*
baptised Verb, reg., trans., act., indic., past defin., sing., 3rd, agreeing with *John* and governs *disciples.*
disciples Com. noun, plur., 3rd, com., obj., gov. by *baptised.*

4. If you were explaining the following line to a class, what should you say about the words printed in italics?—

'Seats beneath the shade,
For talking *age* and whispering *lovers* made.'

(1) *age = old people.* The abstract is used for the concrete. Similarly *youth* is often used for *young people.*

(2) *lovers = sweethearts,* people probably about to be married. The suffix '*er*' denotes agency or the doer.

5. (*a*) What is meant by 'Comparison of Adjectives.' (*b*) Give instances of irregular forms.

(*a*) Comparison of adjectives is the expression (by variation or change of form) of the possession of a quality or attribute in a higher degree by one object than by another, or than by all others; as 'Italy is a *large* country in Europe'; 'France is a *larger* country in Europe;' 'Russia is the *largest* country in Europe.'

(*b*)

Positive.	*Comparative.*	*Superlative.*
good	better	best
bad, evil, ill	worse	worst
far	farther	farthest
fore	—	first
forth (Adv.)	further	furthest
late	later, latter	latest, last
little	less, lesser	least
much, many	more	most
old	elder	eldest

6. Give examples of Latin words which came into English (1) through French, and (2) direct.

Latin.	*Through French.*	*Direct.*
balsamum	balsam	balm
captivus	captive	caitiff
dilitare	dilate	delay
factus	fact	feat
hospitale	hospital	hotel
legalis	legal	loyal
oratio	oration	orison
pœnitentia	penitence	penance
ratio	rational	reasonable
superficies	superficies	surface
traditio	tradition	treason

(ii.) BOYS AND GIRLS.—SECOND YEAR.

1. (*a*) Analyse the following sentences; (*b*) Parse also the words printed in italic:—

'Goldsmith compiled histories *without* much learning about the people he *was writing of;* yet he *did* not make them *false* or foolish, *because* he had more notion than many diligent historians have of *what* men *must* be *like* in any latitudes.'

(*a*) ANALYSIS.

Sentence.	Kind of Sentence.	Subject.		Predicate.		Object.	
		Simple.	Enlargement.	Simple.	Extension.	Simple.	Enlargement.
A. Goldsmith compiled histories . . . . . people he was writing of	Principal.	Goldsmith	without much learning about . . . writing of	compiled		histories	
A (2). He was writing of [whom]	Adj. qual. *people.*	he		was writing	of [whom]		
B. Yet he did not make them false . . in any latitudes	Principal, adversative to *A.*	he		did make	not	them false or foolish	
(2) Because he had more notion . . . . . any latitudes	Adv., modifies *make.*	he	(because)	had		notion	more than many diligent . . . . latitudes
(2) (*a*) Than many diligent historians have [notion]	Adv., modifies *more.*	historians	many diligent (than)	have		[notion]	
(2) (*b*) What men must be like in any latitudes	Noun sent., gov. by *of.*	men		must		[to] be like what	in any latitude

(*b*) *without* Prep., gov. *learning.*
was writing Verb., irreg., intrans., indic., imperf., sing., 3rd, agrees with *he.*
of Prep., gov. [*whom*].
did Verb, irreg., trans., act., indic., past (aux. of tense), sing., 3rd, agrees with *he* and governs *make.*
false Adject of quality, posit., qual. *them* factitively.
because Causal conjunction, joins two sentences.
what Indef. pron., sing., 3rd, neut., obj. (dative), qual. *like.*
must Verb, irreg., indeterminate, trans., act., indic., pres., plur., 3rd, agrees with *men* and gov. *be.*
like Adj. of quality, posit., qual. *men.*

2. Re-write the following passage in words of your own :—

'O, it is excellent
To have a giant's strength ; but it is tyrannous
To use it like a giant.
Merciful Heaven,
That rather with thy sharp and sulphurous bolt
Split'st the unwedgeable and gnarled oak
Than the soft myrtle ; but man, proud man,
Drest in a little brief authority,
Plays such fantastic tricks before high Heaven
As make the angels weep ; who with our spleens
Would all themselves laugh mortal.'

Superhuman strength is most valuable in itself, but monstrous if exerted with superhuman cruelty.

Kind Providence which rends the uncleavable and knotted oak with its destructive and mephitic lightning, yet spares the tender myrtle. In opposition to this, mankind, haughty when clad in its shortlived power, indulges in such pranks in sight of all as to draw tears from immortal spirits, although our foibles are sufficient to cause them almost human merriment.

3. (*a*) Define 'Adjective,' and (*b*) show how an adjective may be replaced by a phrase or a sentence.

(*a*) Adjectives are words attached to nouns (1) to define things, (2) to describe things, and (3) to enumerate or declare the amount of things ; as (1) 'The *black* man, not the white,' (2) 'A *wise* son gladdens his father,' (3) 'We ate *many* pears, drank *no* wine, but *three* cups of tea, and consumed *much* provision.'

(*b*) 'He was *kind*' (adjective) ; 'He was *of a kind disposition*' (adjective phrase) ; 'He was such *as kind men are* ; (adjective sentence).

4. Distinguish between moods and tenses, with examples.

Mood is that mode or manner of using the verb, which expresses the kind of judgment arrived at by the mind, or the attitude of the will, as 'It *is* so' (indic.), '*Come* away' (imper.), '*Were* it so, I care not' (subj.). The infinitive is not properly a mood.

Tense is a change in the form of a verb to express the time or completeness of an action or state.

Examples :—

Present	indefinite	as	I love.
,,	imperfect	,,	I am loving.
,,	perfect	,,	I have loved.
,,	,, progressive	,,	I have been loving.
Past	indefinite	,,	I loved.
,,	imperfect	,,	I was loving.
,,	perfect	,,	I had loved.
,,	,, progressive	,,	I had been loving.
Future	indefinite	,,	I shall love.
,,	imperfect	,,	I shall be loving.
,,	perfect	,,	I shall have loved.
,,	,, progressive	,,	I shall have been loving.

5. What do you know about the prefixes and suffixes of the following words :—recur, suffer, lotion, society, preclude, direct, visible ?

Word.	Prefix.	Suffix.	Meaning of Word.
recur	*re* = again		to happen again.
suffer	*sub* = under		to labour under.
lotion		*tion* = substantising .	a wash.
society		*ty* = state of	a state of alliance
preclude	*pre* = before		to shut before, to prevent.
direct	*dis* = apart, from		to set right from, to guide.
visible		*ble* = able	able to be seen.

6. How does a relative pronoun differ from other pronouns ? Give examples.

A relative pronoun differs from other pronouns in having a conjunctive as well as a representing power; *e.g.*, 'This is he *who* spake,' 'I will shew you the horse *which* I want,' 'He deserves *such* as I.'

III. Pupil-Teachers for April Examination.

A. *Geography.*
First year, of Scotland.
Second year, of Scandinavia, Holland, Belgium, France.
Third year, Africa North of Equator.

B. *History.*
First year, from 827 to 940.
Second year, from 1308 to 1399.
Third year, from 1688 to 1748.

GOVERNMENT TEST QUESTIONS.

First Year.

1. Prove that $\frac{3}{5}$ of $1\frac{1}{4} = \frac{3}{4}$.

2. (*Boys.*) How many packets of tobacco, each containing 3·7 oz., can be made up from 150 lbs.; and what quantity of tobacco will there be left over?

Answers, 648 packets; $2\frac{8}{5}$ oz.

(*Girls.*) Find the G.C.M. of 14003 and 11591, and show that no other number can be their G.C.M. Ans. 67 = G.C.M.

3. (*Boys.*) Simplify $\cfrac{1}{3-\cfrac{1}{3+\cfrac{1}{3-\frac{1}{3}}}}$. Ans. $\frac{21}{55}$.

(*Girls.*) By how much is the sum of $5\frac{7}{8}$ and $9\frac{1}{16}$ greater than the difference of $27\frac{3}{16}$ and $12\frac{5}{8}$? Ans. 1.

4. Write in Largehand, *Physiology*, *Quag*, *Rhyme*, *Style*, *Typhoon*.
Write in Smallhand, '*Rolling stones gather no moss.*'

5. Analyse the following lines, and parse the italicised words:—

'And *still* he blew a louder blast,
And gave a *louder* cheer;
Come, Gelert! why art thou the *last*
Llewellyn's *horn* to *hear?*'

6. What are interrogative and relative pronouns? Give examples of both; and also examples showing how the same word may serve both purposes. Name some interrogative adverbs.

7. Give some account of the lake systems of Scotland.

8. Explain why the Rhone enters Lake Geneva as a rapid and turbid stream, and leaves it a clear one.

9. Draw a map of England, south of the Thames.

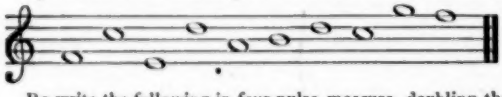
10. For what were the years 51, 410, 597, 779, 835, and 917 noted?

11. Describe the chief characteristics of the Saxons. What do you know of *ordeal*, *ceorl*, *Danelagh*, *Romescot?*

12. '*The three principal invasions of the Danes were prompted by different motives.*' Comment upon this statement.

13. What are the different elements of the manuscript smalls? Show in what letters they occur.

14. Re-write the following two octaves lower on the bass clef:—



OR

Re-write the following in four-pulse measure, doubling the value of every note and rest:—

| d : —. | m : — | s.f : ‖

15. (*Boys.*) Distinguish *hic*, *iste*, *ille*, and write out the dative singular and plural of all three.

(*Girls.*) Fix on calico (by tacking) a hem, a sew and fell seam, and a tuck. Each of the exercises must be three inches in length.

Second Year.

1. (*Boys.*) A train travelling at 70 miles an hour starts 50 minutes later than a previous train travelling at 60 miles an hour; how many miles will the trains have run when the faster one overtakes the slower? Ans. 350 miles.

(*Girls.*) By how much is $7\frac{1}{2}$ hrs. less than $\frac{3}{4}$ of $4\frac{1}{5}$ of $\frac{7}{11}$ of $\frac{5}{6}$ of 15 hrs. 2 mins. Ans. 2 hrs. 4 mins.

2. (*Boys.*) A publican buys nine barrels of ale (each holding 36 gallons) at one guinea a barrel, he loses 24 gallons by leakage; at what price per quart must he sell his ale so as to make a total profit of 7 guineas? Ans. $3\frac{3}{11}$d.

(*Girls.*) Express the difference of $5\frac{3}{11}$ of 24 lbs. 1 oz., and $7\frac{5}{17}$ of 11 lbs. 11 ozs. as a fraction of 563 tons. Ans. $\frac{333}{1008800}$.

3. (*Boys.*) For a certain year, in Bombay, the rainfall was 22·7 inches in June, 23·09 inches in July, 25·8 inches in August, and 12·03 inches in September; what was the total rainfall for those months?

The similar rainfall for the three succeeding years was, respectively, 84·06, 80·2, and 81·3; what was the average rainfall of those four years for those months? Answers, 83·62; 82·295.

(*Girls.*) Write out the rule for Division of Fractions, and explain why, in the division of $\frac{5}{6}$ by $\frac{1}{3}$, the quotient is greater than the dividend.

4. As in First Year.

5. Analyse the following lines, and parse the italicised words:—

'*Those* evening bells, those *evening* bells,
How many a *tale* their music *tells*
Of youth, and home, and *that* sweet time
When last I heard their soothing chime!

Those joyous hours *have passed* away,
And many a heart that then *was gay*,
Within the tomb now darkly *dwells*,
And hears *no more* those evening bells.'

6. What are demonstrative, distributive, and compound relative pronouns respectively? and why are they so called? Give examples.

7. What do you know of the Basques, Magyars, Cossacks, Finns, Sclavs, and Manx? OR,

8. Explain the terms West Longitude, South Latitude. What is the difference in time between a place in 45° W. Longitude and 135° E. Longitude? How is railway time reckoned in the United States?

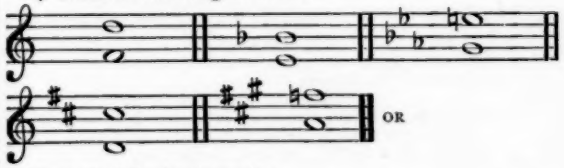
9. Map of Italy.

10. What led to Henry IV.'s accession? Was it a good thing for the country?

11. Give dates of Bannockburn, Sluys, Wat Tyler's Insurrection, Shrewsbury, Agincourt, and Cade's Rebellion.

12. Draw up a table of the Wars of the Roses, giving dates, results, and commanders.

13. What are the chief uses of Mental Arithmetic? Give illustrative exercises.

14. Name the following intervals:—

OR

Name the following intervals:

(*a*) *ray* to *fe*; (*b*) *me* to *doh*^{1}; (*c*) *soh* to *ta*; (*d*) *doh* to *lah*; (*e*) *te*$_1$ to *fe*.

15. (*Boys.*) Give the principal parts of the verbs *facio*, *venio*, *fero*, *dono*, *duco*.

(*Girls.*) Cast on 21 stitches, knit 12 rows, showing how you would make the intakes at the back of a stocking.

16. Write out Euclid I. 26.

Third Year.

1. What is the use of a '*problem*' as an exercise in Arithmetic? Frame two questions containing a problem for *each* of these three standards—third, fourth, fifth.

2. (*Boys.*) Prove that no number terminating in 2, 3, 7, or 8, can be a perfect square.

Find the cost of fencing a square field of ten acres at 3s. 4d. per yard. Ans. £36 13s. 4d.

(*Girls.*) Subtract ·154 of 11 ozs. from ·077 of 2 lbs. 7 ozs., and give the result as a fraction of 11 lbs.

Ans. $\frac{119}{16000}$, or ·0074375.

PUPIL TEACHERS' ROUTINE FOR JUNE, 1894.

DAYS	YEARS	FIRST WEEK			SECOND WEEK			THIRD WEEK			FOURTH WEEK		
		First Lesson	Second Lesson	Third Lesson	First Lesson	Second Lesson	Third Lesson	First Lesson	Second Lesson	Third Lesson	First Lesson	Second Lesson	Third Lesson
MONDAY	1	Analysis and Parsing	How to teach Spelling	Revision of Vulgar Fractions	Analysis and Parsing	How to teach Reading	Metric System	Study Analysis of Sentences from Text-book	Subt. of Algebra. Knitting Socks	Map of Scotland	Analysis and Parsing	Revise Algebra. Stocking-hole Mending	Geography of Australia
	2			Method of Unity. Vulgar Fractions of Money					Multip. of Algebra. Knitting Stocking	Map of Italy		Revise Algebra. Flannel Patch.	Geography of India
	3		How to teach History	Stocks—Short methods with Repeaters		How to teach Arithmetic			Div. of Algebra. Cross-cut Darn.	Map of South Africa or Australia		G.C.M. of Algebra. Hedge-tear Darn	Geography of Asia
TUESDAY	1	Revise any Euclid *or* Needlework	Any Geography *or* Map Drawing	Scripture *or* Revision	Revise any Euclid *or* Needlework	Multip. of Vulgar Fracts. of Weights and Measures	Scripture *or* Revision	Euc. Bk. I., Prop. 3. Paper Patterns of Garments	Divis. of Vulgar Fract. Add. and Subt. of Vulg. Fct.	Scripture *or* Revision	Euc. Bk. I., Prop. 4. Paper Patterns of Garments	English from Text-book (Syntax)	Scripture *or* Revision
	2		Longitude			Method of Unity. Abstract Vulgar Fractions		Euc. Bk. I., Prop. 5. Paper Patterns of Garments	Theory of req. Rules		Euc., Bk. I., Props. 6 & 7. Paper Patterns of Garments		
	3		Winds			Square Root. Simple Practice		Euc., Bk. I., Props. 33, 34. Paper Patterns of Garments	Mensuration of Triangles, Abstract Vulgar Fractions		Euc., Bk. I., Props. 35, 36. Paper Patterns of Garments		
WEDNESDAY	1	History from 787 to 901 A.D.	English from Text-book (Accidence)	Notes of Lessons	Revise History *or* Dates	Prefixes, Roots *or* Affixes	Latin *or* French	History from 901 to 1012 A.D.	Literature, Repetition, and Writing	Singing from Notes	Dynastic Tables	Composition *or* Paraphrasing	Latin *or* French
	2	History from 1189 to 1216 A.D.			History from 1216 to 1270 A.D.			History from 1270 to 1307 A.D.			History from 1307 to 1327 A.D.		
	3	History from 1572 to 1602 A.D.			History from 1602 to 1624 A.D.			History from 1624 to 1637 A.D.			History from 1637 to 1649 A.D.		
THURSDAY	1	Geography of British North America	Compound Practice	Drawing	Geography of British North America	Dates from 410 to 787 A.D.	Drawing	Geography of Scotland	Music	Drawing	Geography of Scotland	Multip. of Algebra. Stocking-hole Mending	Drawing
	2	Geography of India	Division into prop. parts. Proofs of Vulg. Fract. rules		Geography of Europe	Dates from 1189 to 1270 A.D.		Geography of Europe			Geography of Europe	Easy Algebraic Factors. Print Patch.	
	3	Geography of Africa	Fourth Root		Geography of Africa	Dates from 1572 to 1624 A.D.		Geography of Africa			Geography of Africa	L.C.M. of Algebra. Cross-cut Darn	
FRIDAY	1	Problems in Addition and Subt. of Vulg. Fract.	Music	Map of Ireland	Simple Practice	Composition *or* Paraphrasing	Historical Dates	Add. and Subt. of Decimals. Household Accounts.	Lives of Celebrated Persons	Any Mathematics *or* Needlework	Problems in Vulg. Fract. Diff. kinds of Fractions	Dates from 787 to 901 A.D.	Any Mathematics *or* Needlework
	2	Method of Unity. Vulgar Fractions of Money		Map of France	Theory of Propor. Any abstract Vulgar Fractions			Averages. Abstract Decimals			Averages. Abstract Repeaters	Dates from 1270 to 1327 A.D.	
	3	Discount. Theory of Repeating Decimals		Map of India or United States	Stocks. Money Decimals			Problems of Motion. Compound Practice			Mensuration of Triangles, Abstract Decimals	Dates from 1624 to 1649 A.D.	
SATURDAY	1	Latin *or* French	Science	Examination	Latin *or* French	Science	Examination	Latin *or* French	Science	Examination	Latin *or* French	Science	Examination
	2												
	3												

3. (*Boys.*) A train travelling at 50 miles an hour takes 10 seconds to pass a certain point. How long is the train?

Ans. 244⅓ yds.

(*Girls.*) A property is divided among 3 persons in the ratio 17 : 23 : 27; the share of the second is £1,242 3s. 10d., by how much is the share of the third greater than that of the first?

Ans. £540 1s. 8d.

4. As in First Year.

5. Analyse the following lines, and parse the italicised words:—

'*Before* the starry threshold of Jove's court
My mansion *is*, *where* those immortal shapes
Of bright aerial spirits *live inspher'd*
In regions *mild* of calm and serene air;
Above the smoke and stir of this dim spot,
Which men call *earth*.'

6. Place after each of the following words the special preposition which is appropriate to it, and use it in a sentence of your own:—*Reconcile, differ, confer, conversant, independent, confide, absolve, dissent, prevail.*

7. Enumerate the rivers of the East Coast of Africa, giving their source, direction, and approximate length.

8. Where and what are the following:—Timbuctoo, Aliwal South, Kei, Elmina, and Cameroons?

9. Draw a map of South Africa, OR North America.

10. What improvements in manufactures took place in Elizabeth's reign? OR in the eighteenth century?

11. What were the chief events in Ireland from 1625 to 1660, OR from 1780 to 1800?

12. Give dates of Battles of Bosworth, Poyning's Law, Battle of Flodden, Loss of Calais, Massacre of St. Bartholomew, and Authorised Version of Bible; OR of Battles of Killiecrankie, Oudenarde, Dettingen, Albuera, Sobraon, and Tel-el-Kebir.

13. Write out notes of a lesson on one of the following subjects:—(*a*) the Iron Manufacture; (*b*) a Pump; (*c*) Analysis of a Sentence; (*d*) *for infants*, Rain and its Uses; (*e*) the number *Nine*.

14. Name the following intervals:—F to G♯, G♯ to F, G♯ to C, C to G♯; OR

Which of the following is highest, and which lowest, in pitch?—

(*a*) *fah* in Key G. (*d*) *te*, in Key C.
(*b*) *me* in Key B♭. (*e*) *lah* in Key A.
(*c*) *soh* in Key D. (*f*) *me* in Key A♭.

15. (*Boys.*) Give the principal parts of the verbs *volo, hortor, premo, abdo;* OR

(*Girls.*) Work two different kinds of buttonholes, as for the front band of a child's drawers.

16. If the square described on one of the sides of a triangle be equal to the squares described on the other two sides of it, the angle contained by these two sides is a right angle.

17. What is the remainder after dividing

$7x^4 - 9x^3 + 11x^2 - 13x + 15$ by $x - 4$. Ans. 1,355.

18. (*Boys.*) Given the diagonals of a rhombus, find its area. One diagonal of a rhombus is 6, the side is 5. What is the area?

Ans. 24.

(*Girls.*) Plan out the preparation for and proceedings during washing day for an artisan's family.

N.B.—*For Correspondence, see end of Certificate Article.*

THE 1894 SCHOLARSHIP EXAMINATION.

BY DR. GEORGE BEACH, M.A.,

Author *of* '*Elements of English*,' '*A Girls' Arithmetic*,' '*Entertaining Readers*,' *etc.*

I.—(*a*) It is now *too late* for any intending candidates to send in their names to the Education Department for the July Examination; but it is not *too early* to register for the December one.

(*b*) Candidates who have already entered themselves for July should not, even if somewhat unprepared, fail to present themselves. They will thereby obtain most valuable practice and experience without any loss; for at the worse, should they fail, they can present themselves again in December, and non-success at the two examinations will only count as one failure. Moreover, if they succeed, they will be first in the field.

(*c*) To be successful, a candidate need only pass one of the examinations, not both.

(*d*) Candidates whose school examinations take place between now and the first of July should see that their names are duly entered on 'Form IX.,' with the words 'Scholarship Examination' appended.

(*e*) Care must also be taken that the Reading, Repetition, and Teaching marks are duly obtained by the exercises before H.M.I.

(*f*) Don't forget to read Mr. Flux's School Management—one of the most admirable works of its kind ever published.

II.—POINTS TO REVISE.

(*a*) The Lines of Latitude and Longtitude of the required Maps.

(*b*) The Theory of the Tides and of Eclipses.

(*c*) The Geography of British Isles and India—Commercial Geography.

(*d*) Historical Dates, Dynastic Tables, and Tables of Campaigns.

(*e*) Table of English Literature, Syntax and Accidence.

(*f*) The Relative Proportions of Letters.

(*g*) The Theory and Proofs of Arithmetical Rules—Illustrations of Fractional Operations—Repeating Decimals, Stocks, and Discounts.

(*h*) The Time Table of your School—Sets of Object Lessons—Rewards and Punishments.

(*i*) Minor Scales—Typical Tests—Requirements of Syllabus for Scholars.

(*j*) *Algebra.* Factors, G.C.M., L.C.M., Theory of Rules, and especially of Quadratics.

Euclid. The numbers of the most commonly referred to Propositions, Axioms, Definitions, and Postulates—Converse of Propositions—Deductions on Euclid I. 5, on Parallel Lines, and on I. 47—Equivalent Algebraical Formulæ for second book Propositions.

Mensuration. Squares within Squares — Overlapping Squares—Squares within Circles—Circles within Squares—solution of Triangles having given (i.) the Sides, (ii.) the Area and Ratio of the Sides, (iii) Area and Two Sides—solution of easy Trapeziums.

(*k*) *Domestic Economy.* Qualities of Clothing Materials—Post Office Facilities for School Penny Banks—Cooking of Ordinary Foods—Relative Advantages of Cooking Processes—Air, Respiration, Ventilation—First Aid for Injured—Washing Materials and Arrangements.

III. ARITHMETICAL NOTES.

(*a*) *Stocks* is the weakest point in the arithmetic of both sexes.

They are best studied from our '*Girls' Arithmetic*,' and problems of the following species should be carefully analysed:—

(α) To find yearly income, amount and kind of stock being given.

(β) To find yearly income from cash invested in stock, kind of stock and price being given.

(γ) To find amount of stock, kind of stock and income being given.

(δ) To find amount of stock, price of stock and amount of cash purchasing stock being given.

(ε) To find price of stock, amount of stock and amount of cash purchasing stock being given.

(ζ) To find price of stock, kind of stock and actual percentage yielded being given.

(η) To find actual percentage, kind of stock and price of stock being given.

(θ) To find actual percentage, kind of stock, amount of stock, and amount of cash being given.

(ι) To find cash realised, amount of stock and price of stock being given.

(κ) To find cash realised, amount of stock, kind of stock, and actual percentage being given.

(λ) To find kind of stock, the actual percentage and purchasing price being given.

(μ) To find kind of stock, the actual percentage and amount of stock and purchasing cash being given.

Complicating these problems, brokerage as augmenting or decreasing the cash invested or received, and income tax as diminishing the income, must also be considered.

Brokerage is often at the rate of 2s. 6d. per £100 stock ($\frac{1}{8}$ p.c.), and is added to or subtracted from the price of the stock according as the stock is bought or sold.

(δ) *Problems of Motion.*

(α) When a point moves across space at a given rate, then—

(1) Distance = Time × Rate.
(2) Rate = Distance ÷ Time.
(3) Time = Distance ÷ by Rate.

(β) When an elongated body moves across space, it is necessary to add the length of the body to the distance.

How long will it take a provision caravan 400 feet long to pass a wood a mile long at the rate of 4 miles per hour?

Here from (α) $T = \frac{D}{R}$, but D = 1 mile + 400 ft.

$$\therefore T = \frac{5{,}280 \text{ ft.} + 400 \text{ ft.}}{4 \text{ miles per hour}} = \frac{5{,}680 \text{ ft.}}{21{,}120 \text{ ft. per hour}}$$

$$= \frac{5{,}680}{21{,}120 \text{ per hour}} = \frac{71}{264} \text{ hrs.}$$

N.B.—Here it is evident that just as *of* = multiply, *per* = divide.

(γ) When two elongated bodies moving in opposite directions traverse space, it is necessary to add the lengths of both of the bodies, and also to add the rates.

How long will it take two trains moving in opposite directions, to pass each other, the first train being 88 yards long, the second being 77 yards long, and moving respectively at the rate of 70 and 80 miles per hour?

$$T = \frac{D}{R} = \frac{(88 + 77) \text{ yards}}{(80 + 70) \text{ miles per hour}}$$

$$= \frac{165 \text{ yds.}}{264{,}000 \text{ yds. per hour}} = \frac{1}{1{,}600 \text{ per hour}}$$

$$= \frac{1}{1{,}600} \text{ hours.}$$

(δ) When two elongated bodies, both moving in the same direction, traverse space, it is necessary to *add* the lengths of the bodies, and to *subtract* the rate. Taking the previous example (γ) the net rate would have been 10 miles per hour, and—

$$T = \frac{D}{R} = \frac{3}{32} \div \frac{10}{1} = \frac{3}{320} \text{ hours.}$$

(*c*) *Mensurational Arithmetic.*

(α) *Areas.*

(1) A = L × B where A = Area, L = Length, B = breadth.
(2) $B = \frac{A}{L}$.
(3) $L = \frac{A}{B}$.

(β) *Cubical Content.*

(1) C = L × B × H, where C = Cubical Content, L = Length, B = Breadth, H = Height.
(2) $L = \frac{C}{B \times H}$ or Content of a room divided by area of end wall.
(3) $B = \frac{C}{L \times H}$ or Content of a room divided by area of side wall.
(4) $H = \frac{C}{L \times B}$ or Content of room divided by floor area. This is correct whatever be figure of area.

Where Length, Breadth and Height are equal, then

(1) $C = L^3$; (2) $L = \sqrt[3]{C}$; (3) $B = \sqrt[3]{C}$; (4) $H = \sqrt[3]{C}$.

(γ) Area of walls, etc., of any shape can be obtained by multiplying Periphery by Height; A = P × H.

IV. We have made arrangements, merely to suit our own readers, and with no desire to interfere with existing agencies, for tuition during June, based upon these Articles, Routines, and Questions, by experienced teachers and graduates. Names of intending pupils should be sent direct to Dr. G. BEACH, M.A., *Stanley Mount, Macclesfield.* The fees (*to be paid in advance*) are 1s. 6d. per week, or 5s. 6d. the month.

The course for the December Scholarship Examination will commence in our next (July) issue, and the tuition fees will be, for the whole course, £1 9s., or 5s. 6d. per month.

N.B.—For *Correspondence*, see end of Certificate Article.

SELECTED GOVERNMENT QUESTIONS.

FIRST WEEK.

1. In how many ways do Adjectives qualify? Give examples.

2. Write notes of a first lesson on Adverbial Sentences.

3. Draw an outline map, with lines of latitude and longitude, of India, marking the chief rivers, watersheds, and twelve principal towns.

4. Name eight of the most famous buildings in the world, and add any descriptive or historical facts which you know respecting them.

5. Trace briefly the rise of 'The Standing Army.'

6. Compare the English people of the 17th with those of the 19th Century with regard to:—(*a*) Their dwellings; (*b*) Their employments; and (*c*) Their means of locomotion.

7. Write full notes of a lesson on *one* of these subjects:—

(1) (*For Infants.*) The Square and its Properties (either by paper-folding or by drawing).
(2) Adverbs and Adverbial Phrase.
(3) The Rule of Three by the Method of Unity.

8. Show what is the proper use of a blackboard as an aid to recapitulation. Give a specimen of a sketch which should appear on the board at the end of an object lesson.

9. Write the signatures of the relative Major and Minor keys:—B major, F minor, A♭ major, G minor; OR,
What is the name for *fah* sharp, for *te* flat, for *doh* sharp, for *lah* sharp.

10. (*a*) Prove the rule for Division when the divisor is a number larger than 12; *e.g.*, 36,924 ÷ 79. Ans. $467\frac{31}{79}$.

(*b*) How would you explain to children beginning Cubic Measure that 27 cubic feet make a cubic yard?

11. (*a*) Prove to a class beginning Multiplication of Fractions that if the numerator and denominator of a fraction be both divided by the same number the value of the fraction will not be altered; *e.g.*, $\frac{18}{40} = \frac{9}{20}$. Illustrate by half-crowns and sixpences.

(*b*) Give reasons for the rule for finding the discount of a given sum due a given time hence at a given rate per cent. simple interest; *e.g.*, the discount of £299 15s., due 3 years hence, at 3 per cent. per annum simple interest. Ans. £24 15s. 0d.

12. (*Men only.*) Write out Euclid I. 47.
The straight lines joining the bisections of the sides of a triangle divide it into four triangles equal in every respect.

(*Women only.*) Give a list (with cost) of the articles of wearing apparel required for a female teacher about to enter a training college.

13. (*Men only.*) $\frac{x-3}{5} + \frac{x-7}{3} = \frac{x-9}{7} + 9$.
Ans. $27\frac{11}{17}$.

(*Women only.*) Distinguish between the different methods of cooking meat; *i.e.*, roasting, boiling, stewing, broiling, and frying. Explain the advantage and disadvantage of each.

14. (*Men only.*) Find the square root of $25x^4y^2 - 30x^3y^3 + 29x^2y^4 - 12xy^5 + 4y^6$. Ans. $5x^2y - 3xy^2 + 2y^3$.

(*Women only.*) *Thrift* is essential for all young persons. Explain clearly any practical method by which you have been taught to exercise thrift as a pupil-teacher.

15. (*Men only.*) In figure Euclid I. 1, if the radius of each circle be 10, what is the area common to both circles?
Ans. 124 nearly.

(*Women only.*) Cut out in paper, and make up by tacking, a woman's gored flannel petticoat (half size).

16. Translate into English:—
En *entrant* dans le salon, elle *fut* intimidée par l'air de cérémonie et par le silence qui y *régnaient:* jamais elle n'avait *vu* d'appartement si orné, et surtout si bien *éclairé.* La société était nombreuse et *disposée* en groupes: les jeunes gens *jouaient* autour d'une table dans un coin de la chambre, et tous les regards étaient *fixés* sur elle.

17. Parse the verbs in italic, giving their participles.

Second Week.

1. Give the meanings of the prefixes *extra, ob, be, for, anti.* Give the meanings of the affixes *ster, ish, ant, let, al.* Give examples.

2. Analyse the following, and parse the words in italics :—

'But *hear* ye this from me, and mark it *well*—
Of our *own self* we sought not Spain *to wed*,
Or spake the *faintest* word, *till* urged *thereto*
By all our Privy Council. *For* a Queen
Has smaller choice *than* poverty affords,
And lesser *freedom* than the *folk* she rules.'

3. Give notes of a lesson in Physical Geography, *or* in Historical and Commercial Geography of South America.

4. Describe an overland journey from London to Naples, mentioning the most memorable places you would see.

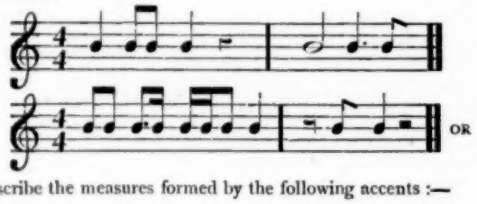
5. Mention times in English History when the countries of the Spanish Peninsula have been in commercial rivalry or at open war with England.

6. Write a short life of William III. What great objects did he seek to obtain and what was the measure of his success?

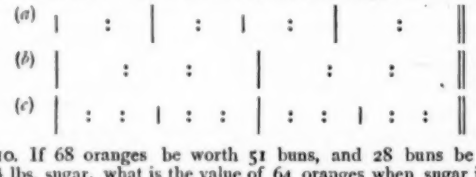
7. Explain what may be done by the help of reading books to impart geographical and historical information in schools in which Geography and History are not taken as class subjects.

8. Classify the capital letters according to the similarity of their forms, and the order in which you would teach them. Give specimens of any six capital letters, carefully written, so as to illustrate their proportions and the rules for their formation.

9. Rewrite the following in $\frac{4}{2}$ time, doubling the value of every note and rest :—



Describe the measures formed by the following accents :—



10. If 68 oranges be worth 51 buns, and 28 buns be worth 10½ lbs. sugar, what is the value of 64 oranges when sugar is 2½d. per lb. Ans. 3s. 9d.

11. If 14 cwt. 3 qrs. 6 lbs. 9 oz. cost £509 8s. 3¾d., what will 11 cwt. 24 lbs. 15 oz. cost? Ans. £386 1s. 2½d.

12. (*Men only.*) Write out Euclid II. 14.

If two right-angled triangles have their hypotenuses and one side equal, they are equal in every respect.

(*Women only.*) Why is the proper ventilation of a bed-room more important than that of a sitting-room? What should be the bed-room's temperature, and how should it be maintained?

13. (*Men only*). Simplify the expressions :—

(a) $\frac{1}{a+b} + \frac{1}{a-b} - \frac{2b}{a^2-b^2}$. Ans. $\frac{2}{a+b}$.

(b) $\frac{a^2-4b^2}{a^2+4ab} \div \frac{a^2-2ab}{ab+4b^2}$. Ans. $\frac{b(a+2b)}{a^2}$.

(*Women only.*) State fully the reasons for keeping a schoolroom well ventilated, the best modes of securing its ventilation, and the effect which different methods of warming the room would have on the ventilation.

14. (*Men only.*) Two trucks, whose wheels are of different sizes, are in motion. One makes 2,002 revolutions more than the other in 7 miles, whereas if its wheels had been twice as large in circumference it would have made 770 less than the other. Find the circumference of the wheels. Ans. $6\frac{2}{7}$ ft. and $10\frac{2}{3}$ ft.

(*Women only.*) Explain clearly the advantages of ready money payments, both to the buyer and seller, and the evil of once getting into debt.

15. (*Men only.*) A triangular space whose sides are in the ratio 5 : 5 : 6 contains 588 square yards. Find the length of its sides. Ans. 35 yds., 35 yds., 42 yds.

(*Women only.*) Make up a small piece of calico into the form of a woman's apron, showing hemming, seaming, gathering (or pleating), stitching, and running.

16. Write short accounts of Sarah, Rebecca, Rachel, Miriam, and Deborah.

17. Who were the twelve disciples? How were they selected? On what occasions were three of them especially honoured?

Third Week.

1. Write in Largehand the words '*Hermits' Habitations.*' Write in Smallhand the words '*The subject oft is greater than his king.*'

2. Analyse the following and parse the italicised words :—

'The river *that* divides *itself*
Loses its vast and powerful *flow:*
The *thought* that runs *in* various ways
Can never grand *or mighty grow.*'

3. Write from Dictation :—

The migration of birds | is governed by certain intelligible laws, | but it varies | in many of its details, | even in the same species, | according to changed conditions. | It may be considered | as an exaggeration of a habit | common to all locomotive animals, | of moving about in search of food. | This habit is greatly restricted | in quadrupeds | by their inability to cross the sea, | or even to pass through | highly cultivated valleys. | As they travel by night | at a considerable height, | their movements are difficult to observe, | and are supposed to be more mysterious | than they perhaps are. | In the tropics | birds move about to different districts | according as certain fruits ripen, | or certain insects become more abundant. |

4. Draw a map of England south of the Mersey and Humber, showing the chief river basins.

5. Give the full meaning of the terms *tropic, meridian, longitude, solstice, coral-reef,* with appropriate diagrams in each case.

6. What feudal relations existed between England and Scotland under Edward the Elder? Trace these relations in subsequent reigns, and show what use Edward I. made of them.

7. In what reign were English possessions on the Continent most widely extended? Sketch briefly their gradual loss.

8. Write full notes of a lesson on *one* of the following subjects :—
(*a*) Leather ; (*b*) Mountains ; (*c*) Joan of Arc ; (*d*) Railways.

9. Draw a plan of the schoolroom with which you are most familiar, showing the position of the desks, etc.? Explain the advantage of the arrangements.

10. Between what notes of the scale are minor seconds, major thirds, and perfect fourths?

11. A can give B 10 yards and C 21 yards start in a race of 120 yards, and B can give C 1½ seconds start over the same distance: how long does it take each to run the course? Ans. 15, 13½, 12⅔ seconds.

12. In what time will £645·75 amount to £960·553125 at 4·125 per cent. per annum. Ans. $9\frac{9}{11}$ years.

13. (*Men only.*) Write down the algebraical formulæ corresponding to the Theorems of the Second Book of Euclid.

(*Women only.*) Describe the different methods of darning, and the purposes of the stitch, naming the garments and materials on which it is generally used.

14. (*Men only.*) (*a*) Divide $\frac{1}{2}a^3 + \frac{3}{2}a^2x - 2x^3$ by $\frac{1}{2}a + x$. Ans. $a^2 + ax - 2x^2$.

(*b*) Find the G.C.M. of $x^3y + 2x^2y^2 + 2xy^3 + y^4$ and $5x^3 + 10x^2y + 5x^3y^2$. Ans. $x + y$.

(*Women only.*) How would you spend £8 on an outfit for a girl of 15 going to her first place, who was to leave her old clothes for the younger sisters?

15. (*Men only.*) A grocer bought 2 cwt. of sugar at $2\frac{1}{2}\frac{1}{2}$d. per lb. By selling a part at 18s. 8d. per cwt., and the remainder at 5s. 10d. per qr., he lost on the whole transaction 12½ per cent. How much did he sell at each price? Ans. 70 lbs. and 154 lbs.

(*Women only.*) Say how cheese is made, and what kinds of cheese contain the largest amount of nutriment.

16. (*Men only.*) A circle and an equilateral triangle have the same perimeter. Compare their areas. Ans. As $21\sqrt{3} : 22$.

SCHOLARSHIP OR FOURTH YEAR ROUTINE FOR JUNE, 1894.

DAYS	FIRST WEEK			SECOND WEEK			THIRD WEEK			FOURTH WEEK			
	First Hour	Second Hour	Third Hour	First Hour	Second Hour	Third Hour	First Hour	Second Hour	Third Hour	First Hour	Second Hour	Third Hour	
MONDAY	Problems leading to Quadratics — Functions of Food	History from 1660 to 1702	'De Bello Gallico,' or 'La Jeune Silvérienne'	Algebraic Factors — Clothing	Dates from 1660 to 1740	Latin or French Grammar	Problems leading to Quadratics — Ventilation. Drainage	History from 1780 to 1810	'De Bello Gallico' or 'La Jeune Silvérienne'	Simultaneous Equations — Miscellaneous English	Reign of Queen Victoria	Latin or French Grammar	
TUESDAY	First 26 Propositions of Euclid, Book I. — Preparation of Food	Political Geography of North America	Revise First Year Music	Euclid, Book II. — Patterns of Chemise, Drawers, Flannel Petticoat	General Geography of Europe	Revise Second Year Music	Props. 27 to 48 Euclid, Book I. — Patches	General Geography of Africa	Revise Third Year Music	Euclid, Book II. — Patches	The Planetary System	Revise Fourth Year Music	
WEDNESDAY	L.C.M. and G.C.M. Problems	Latin Affixes	How to Teach Drawing	Mensuration — Stocks	Greek and Teutonic Affixes	Dates from 1740 to 1820	Clock Sums	Tables of the Parts of Speech	The Requirements of the Code for the Standards	Problems of Motion or Management of the Sick Room	Tables of the Parts of Speech	The Qualities of a Good Series of Reading Books	
THURSDAY	Problems leading to Quadratics — School Penny Banks	History from 1702 to 1740	Paraphrasing and Parsing	Algebraic G.C.M. and H.C.F. — Washing	History from 1740 to 1780	Analysis and Parsing	Cube and Square Root of Algebra — Warming the Dwelling	History from 1810 to 1837	Paraphrasing and Repetition	Simultaneous Equations (Problems) — Miscellaneous English	Dates from 1820 to 1893	English Grammar from Text Book	
FRIDAY	Notes on Euclid, Book II. — Calico Sampler	Map of Canada	Averages and Percentages	Deductions on Euclid, Book I. — Flannel Sampler	General Geography of Australia	Arithmetic from last Month's Article	Deductions on Euclid, Book II. — Diagram of Chemise	The Seasons	Mixtures	Notes on Euclid, Book I. — Diagram of Nightshirt	Map of Australia	Mixed Vulgar and Decimal Fractions	
SATURDAY	Latin or French Grammar	Examination	English Composition	'De Bello Gallico' or 'La Jeune Silvérienne'	Examination	Mensuration or Cleaning the Dwelling	Latin or French Grammar	Examination	English Composition	'De Bello Gallico' or French Grammar	Examination	Euclid or Rules for Preserving Health	

(*Women only.*) Cut out and tack together a paper pattern of one leg of a pair of drawers for a child three years of age.

17. Write in French: (*a*) Thirty-one; (*b*) the forty-fourth; (*c*) Charles the Ninth; (*d*) here is your hat; (*e*) I have seen nobody; (*f*) your greatest enemy; (*g*) I am going away; (*h*) I have walked; (*i*) His Majesty the King.

18. Translate:—La religieuse *se* remit à *genoux; pendant qu'*elle psalmodiait les prières, la *mourant faisait* de temps en temps des *signes* de croix. La nuit devint *sombre.*

Lorsque les religieuses revinrent *avec* de la lumière Prascovie n'existait *plus.*

Parse the words in italics.

FOURTH WEEK.

1. Write in Largehand the words '*Idylls of the King.*'
Write in Smallhand the words '*He prayeth best who loveth best.*'

2. Explain the following passage and give illustrative instances:—
'We find that, for the most part, *Generic* and complex *Abstract* terms are of Classical, but that *Specific* and *Concrete* terms are of Saxon, origin.'

3. Classify Irregular Verbs.

4. Write from Dictation and punctuate:—
As for the barbarian hordes | of early ages, | we hear indeed | of their coming | like a cloud from the East | and sweeping over Europe | with the sudden destructiveness | of a thunderstorm | or a swarm of locusts, | but their migrations | have little or no interest for us, | except in their immediate | or their ultimate effects | upon civilised nations. | Those races may be regarded | as out of history, | whose doings form no part | of the one great connected tale of human progress, | and which might indeed | be left out of mention altogether | without our understanding | the story less well. | It is only when barbarians | come into contact | with the progressing, | building, | discovering, | reading, | writing, | thinking world | that they have any history. |

5. Describe the position of Iceland, Chios, Heligoland, Minorca and Cyprus, and name the country to which each belongs.

6. Into which of the British and Irish ports would flax, jute, cotton, wool, hemp, and hides be chiefly imported? Discuss the convenience of the ports for the districts of manufacture.

7. Name, with dates, the principal events connected with York, Lincoln, and Dover.

8. Give some account of the causes of the War of American Independence, and mention in chronological order the chief events.

9. Make and explain diagrams to illustrate the following:—
$(a)\ \frac{1}{2}(\frac{1}{3}-\frac{1}{4}) = \frac{1}{24}$; $(b)\ (\frac{1}{3}-\frac{1}{4}) \div \frac{1}{2} = \frac{1}{4}$.

10. How far is it in the power of a teacher, by other means than formal school lessons, to improve the habits, manners, and character of the scholars?

11. (*a*) What notes in the scale of B♭ correspond with E, F, and B in the scale of C?
(*b*) What are the relative minor keys of A♭ and D? OR
What modulation usually takes place in two sharp removes? In two flat removes?

12. A hundred coins, consisting of half-crowns and florins, are worth £11 8s. 0d. Find the number of each.
Ans. 56 half-crowns, 44 florins.

13. A man possesses ·765 of an estate. He sells ·19 of his share for £612; what is ·2 per cent. of the value of the whole estate?
Ans. £8.

14. (*a*) (*Men only.*) Given the middle points of the sides of a triangle: construct it.
(*b*) Divide a line so that four times the rectangle contained by the two parts shall be equal to the square on the whole line.

(*Women only.*) Name the best ways known to you for making use of the scraps and remnants of bread.

15. (*Men only.*) (*a*) Prove that $(1+x)(1+y)-xy(1-x)(1-y)$ contains $1+xy$ as a factor, and find the other factor.
Ans. $(1+x+y-xy)$.

(*b*) Simplify $\frac{1}{x-1} - \frac{1}{2(x+1)} - \frac{x-3}{2(x^2+1)}$.
Ans. $\frac{x(3x+1)}{(x^2+1)(x^2-1)}$.

(*Women only.*) Show the importance of physical training as part of the employment of an elementary school; and describe in detail the exercises which you have found best fitted to improve the health, activity, and cheerfulness of scholars.

16. (*Men only.*) Solve the equations:—

(*a*) $\frac{2x-3}{x-2} - \frac{1}{6} = \frac{1-2x}{1-x}$. Ans. $x = 4$, or 1.

(*b*) $\left.\begin{array}{l} \frac{x+3y}{4} + \frac{3x+y}{12} = 11 \\ x+y = 8(y-x) \end{array}\right\}$ Ans. $x = 7, y = 9$.

(*Women only.*) Give simple practical directions for making starch, and for washing and getting up linen collars and cuffs.

17. (*Men only.*) Two adjacent sides of a quadrilateral field are at right-angles, and their lengths are 78 and 104 yards respectively. The other two sides with the diagonal form an equilateral triangle. Find the area of the field. Ans. 11373·7 square yds.

(*Women only.*) Make up a small apron, showing hemming, seaming, gathering, and setting-in. Make a button-hole. Sew on a button, and fix and run two tucks.

18. What are the five chief sections of the Catechism? When is it to be used?

19. How do the forms or words of our Morning and Evening Service inculcate the doctrine of the Trinity?

NEW COMPOSITION STORIES.—STANDARD V.

Suitable for 'Unseen Tests' in Reading also.

163.

CHEATING HIMSELF.—As a farmer was one day walking along the banks of a stream which ran past his grounds, he noticed a man trying to drive some geese on to a barge. As he seemed to have great difficulty in accomplishing his task, the farmer very kindly stopped and assisted him. The next morning his bailiff came in a great fright to say that all the geese had been stolen, and the unfortunate farmer discovered that he had been helping the thief to steal his own geese!

164.

THE CAPTAIN'S REQUEST.—A pious captain, about to take the command of a ship, assembled the crew on the deck, and said, 'My lads, there is one law I am determined to make, and I shall insist on its being kept. It is a favour I ask of you, and which, as a British officer, I expect will be granted by a crew of British seamen. What say you, lads, are you willing to grant your new captain one favour?' 'Ay, ay, sir; let us know what it is,' cried they all. 'Well, lads, it is this: that you will allow me to swear the first oath in this ship. What say you, will you grant me this favour?' The men stared, and for a moment were quite at a loss what to say. The appeal seemed so reasonable, and the manner of the captain so kind and persuasive, that a general burst from the crew answered, 'Ay, ay, sir,' with their usual three cheers. Swearing was thus abolished in the ship.

165.

THE DUELLISTS AND THE GIBBET.—Frederick the Great is said to have taken the following successful method of suppressing duelling in his army:—An officer desired his permission to fight a duel with a fellow-officer. He gave his consent, with the understanding that himself would be a spectator of the conflict. The hour of meeting arrived, and the parties repaired to the place of slaughter. But what was their surprise to find a gibbet erected upon the spot. The challenger inquired of Frederick, who was present according to agreement, what this meant. 'I intend,' said he, sternly, 'to hang the survivor!' This was enough. The duel was not fought; and by this simple but effectual means it is said duelling was broken up in the army.

166.

A SMART SOLDIER.—A great Russian general was in the habit of asking his men difficult questions, and bestowing favours on those who showed presence of mind in answering them. Once he was prowling at night round the camp, looking for a chance of playing one of his usual tricks. He was very lightly clad, although it was a bitterly cold night. Suddenly he came upon a sentinel, and called out to him, 'How many stars are there in the sky?' The soldier knew the general's voice at once, but pretending not to recognise him, he replied, 'Just wait a bit, and I will count them for you,' and began deliberately to do so. To the sentry, wrapped in his thick coat, this was a good joke enough; but the thinly-clad

general soon found it much colder than he liked, and when the soldier had got up to one hundred, and was still counting away as if he would never leave off, the general stopped him short, and having taken his name, made off as fast as his half frozen feet would carry him. But the next morning the shrewd sentry was made a corporal.

167.

THE BEST PRESENT.—The three sons of a lady were invited to furnish her with an expression of their love before she went a long journey. One brought a marble tablet, with her name inscribed on it; another presented her with a rich garland of flowers; the third entered her presence, and thus spoke: 'Mother, I have neither marble tablet nor nosegay, but I have a heart; here your name is engraved, here your memory is precious, and this heart, full of affection, will follow you wherever you travel, and remain with you wherever you repose.'

168.

A USEFUL LEG.—A one-legged duck-hunter had a curious adventure while on the water in a skiff. He had lost his leg in a railway accident, and wore a cork substitute, useful for ordinary purposes, but which prevented him from following game except in a boat. On this occasion he had almost loaded the skiff with ducks, when, on reaching after a particularly fine bird, he overreached, and upset the boat. Down went the hunter, and as there was a swift current at that point, the boat drifted away before he came to the surface. Being unable to swim, the hunter clutched wildly for support, but found none, and would certainly have been drowned had it not been for his cork leg. It kept him afloat, and at first he was overjoyed; then he became apprehensive. The cork leg had a tendency to invert him in the water, but after struggling against this for some time, he managed to unstrap the limb and use it as a float. It was easy thus to paddle ashore, and the hunter was saved.

169.

A NEW FASHION.—A servant girl happened to be engaged at a farm-house where the mistress was known to have a rather hasty temper. On the first Saturday night the girl was told to clean the boots and shoes for Sunday. Coming into the kitchen a short time afterwards, the mistress, seeing that the maid had cleaned her own boots first, was so enraged that she lifted them and threw them into a tub of water which stood near. The servant made no sign; but when all the boots were cleaned she also lifted them and threw them into the tub of water. 'Why, whatever possessed you to do that?' gasped her mistress in a fury. 'Oh, I thought it was the fashion of the house,' calmly replied the girl.

170.

COUNTING PIGS.—A farmer who had twenty pigs, one day sent his Irish servant to count them, and see if they were all there. Paddy came back slowly, with a puzzled look on his face. 'Well,' said his master, 'are they all right?' 'No,' said Paddy, 'I counted nineteen; but one little fellow ran about so fast I wasn't able to count him at all.'

171.

HOW HE GOT THE BEST OF THE BARGAIN.—A Yankee and a Frenchman owned a pig. When killing-time came, they wished to divide the meat. The Yankee was anxious to get the hind-quarter, and persuaded the Frenchman that the way to divide it was to cut it across the back. This was agreed to, on condition that the Yankee would turn his back, and take the choice of pieces after it was cut in two. The Yankee turned his back accordingly. 'Which will you have—the piece with the tail on, or the piece without the tail on?' 'The piece with the tail on.' 'Then you can take it, and I'll take the other part.' Turning round, the Yankee found that the Frenchman had cut off the tail and stuck it in the pig's mouth.

172.

HOW THE BANK WAS SAVED.—Many years ago there was a run upon a bank. With great difficulty it was met, but at the close of the day but £200 remained, and the next day would bring certain ruin. A report was spread that a large sum had arrived from London, and the manager met the first applicant with the utmost composure. Meanwhile, a bushel measure had been firmly screwed down to the counter, filled to the top with sand, and lightly covered over with the few remaining sovereigns. The customer was requested to lift the measure, or even move it. Of course he failed, apologised to the bankers for the trouble he had given them, went out, and informed the crowd what they might witness for themselves, and the panic was at once allayed.

NEW READING TESTS.—STANDARD III.

Suitable for 'Unseen Tests' in Dictation also.

141.—A gentleman was walking in a meadow one summer evening, and suddenly came upon a great troop of rats. He stood perfectly still, and the whole band passed close to him. He was very much astonished to see an old blind rat, which held a piece of stick at one end of his mouth, while a younger rat had hold of the other end of it; and in this way he was leading his blind companion.

142.—The carrier pigeon is one of the most valuable we possess. Its powers of flight and its certainty of finding its way home from very long distances are truly wonderful. It is a bold, pretty, and most shapely bird, of good size, with a beautifully formed head and straight neck. Around each eye is a band of scarlet skin.

143.—A little while ago some boys were playing in a garden, when one of them, running violently round a corner of the house, met a sparrow flying in the opposite direction. The bird struck the bridge of the boy's nose, making a little hole with the point of its beak, and then fell to the ground dead.

144.—In connection with day schools in Sweden, there is one day set apart to teach the girls to sew, knit, spin, and weave, and the boys to make baskets, tubs, wooden spoons, all of which they can follow up in the long winter evenings, and which will be of use to them in after life. In summer the boys have small gardens, where they are taught to sow seeds, and have the different grasses explained.

145.—Raisins are ripe grapes dried in the sun by placing them on sloping banks of red clay at the foot of a wall, and perfectly protected by wooden covering boards, so as to keep off all rain and dew, either of which is fatal to good quality. The bunches are turned once only, with the greatest care, and in two or three weeks grapes become raisins.

146.—A lady had a horse called Jack, which disliked being groomed. The stablemen kept their brushes in a little cupboard near his stall; but sometimes when they came to groom him they could not find them. So one day they watched him, and saw him slip his halter and go to the cupboard and knock with his nose until he got it open. Then he took out the brushes and hid them under his straw.

147.—He walked by their side, and being very tall, had to bend down a great deal to carry on his conversation with his three little girl-friends. But when they came to a sweet-shop he asked them to wait outside just for a few minutes, as he had some most important business to do in there. When he came out he was carrying three little parcels.—*H.M.I.'s Test.*

148. Oh! summer is a pleasant time,
With all its sounds and sights;
Its dewy mornings, balmy eves,
And tranquil, calm delights.
I sigh when first I see the leaves
Fall yellow on the plain;
And all the winter long I sing,
'Sweet Summer, come again!"

NEW DICTATION TESTS.—STANDARD IV.

Suitable for 'Unseen Tests' in Reading also.

No. 84.

Not only by our example, but even more by unconscious influence, are others being helped or hurt. We are a part of their surroundings, and they are a part of ours; and, as such, we are all helping to form each other's character by our daily life. As we are and as we do, so we teach others to be and to do, though we utter no word of instruction or advice.

No. 85.

The old Romans were before all things a military people. Consequently, they took care to confer rewards upon soldiers for bravery and other forms of service so as to preserve proper spirit among the men. One of these rewards of valour was a crown, and was bestowed upon the soldier who was the first to mount the enemy's rampart. It consisted of a circle of gold. One can imagine with what zeal an attack would be made, and how hotly the foremost place would be struggled for, so that the crown might be won.

No. 86.

The stems of grass and oats are usually hollow, and the knots which occur at intervals, and which have a peculiar degree of firmness, derived from the interlacing of fibres, give them a strength which they would otherwise lack. If the material of wheat straw were in a solid form it would make but a thin, wiry stem, which would snap with great ease, but in the hollow form, with the intervening knots, the necessary support is afforded.

No. 87.

Attention to cleanliness is decidedly favourable to long life, and we may congratulate ourselves on the general improvement in our habit in this respect. Frequent washing with warm water is very advantageous for old people, in whom the skin is only too apt to become hard and dry; and the benefit will be increased if succeeded by friction with coarse flannel or linen gloves, or with a flesh brush. Every part of the skin should thus be washed and rubbed daily.

No. 88.

The finest railway train in Europe is probably that built by the South Eastern Railway Company for the accommodation of the Prince of Wales in his journeys on their line. It consists of seven rooms, comprising a couple of drawing-rooms, a study and library, a couple of bed-rooms, a dressing-room, and a bath-room. The bed-room, luxuriously furnished in old gold silk, with beautifully painted panels, is a most elegant little apartment, and of course the entire train is lighted by electricity.

No. 89.

In the early days of the electric telegraph the receipt of a message by wire was an exciting event, even in homes in the great centres of population; for it was only on very important occasions that the telegraph was resorted to. Now messages of this kind are familiar to most persons, and the excitement of bygone times has ceased to show itself when a telegraph messenger is seen to approach the door.

No. 90.

The great storm—the most violent ever known in England—occurred in November 1703. The lead on the roofs of several churches was rolled up like scrolls of parchment; giant oaks were torn up by the roots, and even in the Thames vessels and barges were sunk. The fleet suffered terribly; in the navy alone fifteen hundred seamen were lost, and in the merchant service a far greater number. The damage done in London by the great storm is estimated at a million of money.—*H.M.I.'s Test.*

No. 91.

Come, let us be happy together,
For where there's a will there's a way,
And the heart is as light as a feather,
If maxims like mine bear the sway.
First pack up a store of contentment,
Who knows not the way is a dunce;
If wrong'd, never dream of resentment,
Get rid of such folly at once.

STANDARDS V.—VII.

No. 75.

The canary born in a cage, of caged ancestry, is utterly incapacitated for freedom. So far from being a kindness to give him his liberty, it is a positive cruelty. He has never sought food or shelter; he has no notion of doing either, and he must inevitably perish. Birds that have been taken from the nest are in a similar condition of ignorance. Unless kept in captivity a very short time, and afterwards supplied with food till they learn to care for themselves, to thrust them out is like taking a child brought up in luxury, and forcing him into the streets to pick up his own living. This comparison is not in the least exaggerated. A young bird is taught by his parents where and how to get his food. Close observers may see this instruction going on all summer, when nesting is over and young birds are out. If, then, this period of instruction is passed in a house, and he is adult when turned adrift, there is no one to teach him, and he must learn by hard experience, or die in the attempt.

No. 76.

Arab slave dealers in East Africa are trying a new scheme to defeat Europeans bent upon suppressing the slave trade. It has been their practice to treat their weaker captives with great cruelty. They have now begun the policy of kindness and indulgence. The newly caught slaves are placed in the care of older bondsmen, receive plenty of food and drink, and are encouraged in the most dissolute practices. Thus gradually persuaded that slavery is really a rather pleasant thing, they are taken to the coast without chains or other tokens that would betray their servile condition. They are loaded with merchandise, and under the name of porters, both men and women are brought down to the sea, in spite of the interdict against this practice.

No. 77.

Years ago a pin had to pass through the hands of fourteen or fifteen men before it was fit for use. Now-a-days one machine turns out pins all ready for use at the rate of two hundred a minute. The wire is prepared by drawing it from a large coil through a hole the size that the pin is wanted. The wire, when it is made the right size, is wound on an enormous reel, and hung over the machine. Then there are a pair of pincers, which, moving backwards and forwards, pull it along and thrust the end through a hole in a small iron plate, on the further end of which a small hammer taps the end of the wire and the head of the pin is made. A knife cuts off the pins the length that they are required. The pins drop through a little slit, through which the heads cannot pass. Here they hang, while the ends are filed and sharpened. The pin is now made, and only needs to be cleaned and polished.

No. 78.

It is a great mistake to suppose that China still shuts herself up and refuses to keep step with the outer world. She has a comprehensive system of telegraph lines running to all parts of the country. The governors of the provinces keep watch over the lines, and take care that they are maintained in working order. The Pekin Government is now preparing to establish a railway system not less comprehensive, with main and branch lines extending over the empire from its northern boundary to the sea-board. Shiploads of rails have arrived at Shanghai within the past few months, and it is reported that the work of laying them will be begun early next year.

No. 79.

The origin of the large bottles containing coloured waters, placed by chemists in their windows, is due, like the symbolical figures often seen upon the bottles in question, to those most ancient chemists the Moors. They frequently make their own chemicals, and for that purpose, as also for experimenting, they used retorts, &c., many of which were in the shape of bottles; these vessels became connected in the minds of the public with the men who used them, and were a sure sign of the dwelling-place of a chemist, alchemist, or often of a magician.

No. 80.

A scheme for encouraging thrift in elementary schools has been adopted by the Post Office. It is found that in many elementary schools the requirements do not justify the establishment of a penny bank, and it is in such cases that the Post Office now proposes to supply not only the familiar stamp-saving slips, but also a stock of stamps on credit, which the masters or teachers can exchange for the pence saved. Arrangements will then be made for a clerk from the local post-office to call periodically to receive the stamp forms, when filled up, as deposits in the Post Office Savings Bank, either to new accounts or accounts already opened.

No. 81.

The only animal that can compete with man in powers of endurance is the camel, which can live for ten or even fifteen days without water, and can perform its tedious journeys across the arid deserts of the East for days without nutriment. The camel not only carries its own supply of water, but has in its hump a natural storehouse of nutriment, upon which it can draw as occasion requires. The flesh of which the hump consists is gradually drawn into the system, and no Arab will allow his camel to start on a journey until its hump is in perfect condition and hard to the touch. Little is seen of it by the time the animal reaches its destination but folds of skin lying loosely on the back.

No. 82.

There is a fair and sea-girt isle
Whose home is 'mid the waves,
Where Liberty's benignant smile
Doth freemen make of slaves!
And to all eyes BRITANNIA rears,
As Empress of the seas,
The flag that braved a thousand years
The battle and the breeze!
And while Old England rears with pride
Her lion flag unfurl'd,
It shall proclaim her far and wide
The mistress of the world.

PAPERS FOR PUPIL TEACHERS.

BY JOHN ADAMS, M.A., B.SC., F.C.P., ETC.
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OUT OF SCHOOL.

In this, the last of the papers I shall write for you, I have been recommended to speak of the Pupil-Teacher's leisure. If I had adopted the suggestion this article would have been remarkably short. The shortest essay I ever heard of was written on 'The Snakes of Iceland.' It consisted of the one sentence: '*There are no snakes in Iceland.*' In the same way I might very well have put the matter in a nutshell by saying 'The Pupil-Teacher has no leisure.'

Still, hard-worked as you are, you are not always in school, and it is interesting to talk about what you do out of school hours, and what you should do. A certain portion, often too large a portion, of your time must be given to the preparation of your own studies. About this time of study there are two things you should bear in mind:—

1. It does not pay to study when you are worn out. Some Pupil-Teachers seem to think that the important question is, 'How long can I study each evening? The real question is, 'How much can I learn each evening?' By hanging over your books when you are tired you not only do not learn much, but you get into a habit of *half-attention* which is THE most fatal fault a student can have. Two hours' hard work produces more results than four hours' easy-going work, besides forming the most essential habit in study, the power of concentration. In study, two and two do not make four.

2. You should always study by a time-table. Here it is necessary to give a caution,—Make your time-table reasonable to begin with. You know the cheery way folks at night make up their minds to rise at, say, half-past five next morning, and how ashamed they are as they sneak down to the nine o'clock breakfast afterwards. This is exactly the fault of most students who make up time-tables. They are so virtuous while they are laying out their time that human nature cannot live up to their ideal. The main purpose of a time-table is not, as some moralists would tell us, to act as a sort of outside conscience; if our inside conscience does not attend to its business, the outside one has a poor chance. The real value of the time-table is the proper distribution of time. Do as your teachers may, you will find that on some nights your work is heavier than on others, with the consequence that on some mornings it is not so well done as on others. A time-table made up for a week puts this all right; you do not live from hand to mouth. Some of Thursday's hard work has been done on Tuesday. 'Sufficient unto the day is the evil thereof,' no doubt; but lessons are not evils. At least they should not be, though some over-eager students make them evils. The schoolmaster is not a popular character as he is found in literature, and the pupil-teacher, so far as he finds a place at all in literature, shares the master's unpopularity. One of the least lovely of all Dickens's characters is the pupil-teacher Charley Hexham in 'Our Mutual Friend.' Charley is continually taking stock of his mental furniture, and is never done passing all his knowledge in review to make sure that he has lost none of it. It is not that he loves knowledge, but that he wants to 'get on.' 'Getting on' is the beginning and end of his efforts. I like to believe that Charley is a very exceptional style of pupil-teacher. Not many of you, I think, would grudge a kind word to a sister because it took up your time, and prevented you from 'getting on.'

Even the most eager students among you must have some 'off time.' Friday night cometh alike to the zealous and the careless. Other professions and trades have their patron saints; why should Teaching be left without one? Why, indeed, when Saint Vendredi stands waiting to be adopted? I always suspect a teacher who is not a true worshipper of Saint Friday. If he doesn't enjoy Friday evening it means that he has not worked well enough during the week to merit enjoying it. In some few cases he does not enjoy it because he has to work on Saturday. In such cases we accept his apology, but no other excuse can be received for the neglect of the worship of Saint Friday.

Then how is this good Saint, this patron of leisure, to be worshipped? Not, surely, by lounging in an easy-chair before a comfortable fire: not in general, at any rate. If you feel that this is the way you really would enjoy it best, then there is something wrong. At your age this arm-chair worship is unnatural, and must mean either that you are in really bad health, or that your school is taking too much out of you. You should consult your doctor; if he proves of no good, try what your head-teacher says.

Leaving the sick, the over-worked, and the lazy out of account, the big majority of pupil-teachers are left wondering how best to spend their scanty leisure. Here, as in reading, it is absurd to lay down hard-and-fast rules. The first and chief rule is, Do what you like to do. The second is, Let it be something as far removed from school-work as possible.

Properly speaking these make only one rule, for if you have done an honest week's work as a pupil-teacher you will want to have nothing to do with school-books or school anything else. It must be for others to guide you in your selection of out-of-

school occupations: others who know your size, and weight, the shade of your complexion and the colour of your eyes; others, in fact, who know more about you than I do. For only those who know all about you can advise you correctly.

Now no one knows you altogether; but the one who knows you best of all is yourself. And thereby hangs (if not a tale, at least) a moral. You are your own best advisers. Every magazine you take up invites you, through its advertising columns, to be your own lawyer, joiner, bookbinder, doctor, and so forth. 'Every man his own lawyer' is a rule that leads to mischief; 'Every man his own adviser' is a motto that every pupil-teacher should practise his copy-setting hand on.

Now-a-days there is a craving for advice, or more probably a craving to give advice, that overloads all the columns of print meant for young folks. From the lofty heights of the clergyman's printed 'Talks with Young Men,' down to these modest 'Papers for Pupil-Teachers,' there is a continuous stream of advice pouring upon young people.

Now advice is very like Compound Proportion: it's all mighty fine *if* we know all the conditions. A pedantic schoolmaster is quite sure that if 8 boys eat 24 apples in 5 days, 10 boys will eat 96 apples in 16 days. A wise parent has his doubts about it.

So with advice. There are some mean people who do not like to pay their doctor. When they feel a pain in the side they don't ask the doctor's advice. They hunt about among their friends till they find some one who has had a pain in *his* side, and who has gone to a doctor. They get a loan of the doctor's prescription, and buy the bottle; they can't avoid *that* outlay—unless, indeed, the friend has some of the mixture left in the bottle. Such people often all but poison themselves with unsuitable medicine, because they think that the same advice suits everybody.

The doctor prescribes a bottle not for 'a pain in the side,' but for 'the pain in your side.' If it were not so we would all buy Dr. Somebody's 'Family Medicine,' turn up the index for 'Side, pain in,' and act accordingly.

Life has been defined by some one—that is, rational life, not mere existence—as the continual application of old principles to new cases. An adviser can only indicate the principles, and give examples of their application. The advised must make his own decision, in accordance with his fuller knowledge of the facts of his special case.

The general principle at present in question is that it is desirable to have some out-of-school interest as unlike the in-school interests as possible. What this hobby—if you care for this name—is to be, can only be decided by the person who is going to ride it.

In his 'Hard Times' Dickens pokes fun at 140 teachers newly turned out from a training college, all as like one another as 140 pianoforte-legs. It may be replied that this uniformity is not to be so much objected to, so long as the pattern is good; but, after all, it must be admitted that our present educational system has a strong tendency to develop this dead-level. Here you need not look to your teachers for help; they are but part of the system. You must rely upon your outside interest, your hobby, to keep alive your individuality.

Whatever your hobby is, let it be one that will give you elbow-room. From your position in school you are almost forced to rely upon your teacher far too much for direction. Too many pupil-teachers are quite helpless in face of strange circumstances, simply because they are always accustomed to be told 'what to do next.' Not pupil-teachers alone are bondsmen to this craving for 'directions.' It is pitiful to see a cook with one eye on her pot and the other on a copy of 'Directions how to make the Soup'; but it is still more so to see an able-bodied man sitting at the roadside by a 'safety,' rubbing his leg with one hand, and with the other holding open his 'Directions how to Ride,' so as to find out how not to tumble next time.

It is here that our system of class-teaching fails. We arrange the work so well for our pupils, and make all the points so plain that they have no need to make any effort at all. They acquire a great deal of knowledge, but they do not acquire that power of acting for themselves under new circumstances which is worth more than any amount of mere knowledge.

At school the only place where the pupils acquire this power is in the playground; and what is true of the pupil is none the less true of the pupil-teacher. Whether your hobby is to play the guitar, collect butterflies, or ride a bicycle does not matter much; the important thing is that in it you are acting from your own motives, and working out your own plans. You are out of leading-strings. You need not all play cricket, but you should never rest content till you have acquired confidence enough to 'play off your own bat.'

ELEMENTARY LESSONS IN HORTICULTURE.

BY PROFESSOR J. R. GREEN, M.A.,
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VIII.—Birds and Horticulture.

Every reader of Longfellow knows the story of the Birds of Killingworth, how when 'The robin and the blue-bird, piping loud, Filled all the blossoming orchards with their glee, A town meeting was convened straightway To set a price upon the guilty heads Of these marauders, who, in lieu of pay, Levied blackmail upon the garden-beds And corn-fields, and beheld without dismay The awful scarecrow with his fluttering shreds.'

In spite of the plea of the schoolmaster for 'all the throng That dwell in nests and have the gift of song,' the birds were massacred, and round the fields and garden beds when the days were like hot coals, 'hosts of devouring insects crawled and found No foe to check their march till they had made The land a desert without leaf or shade.' Birds are the friends of the gardener and farmer, though the house-sparrow and rook, and that pretty bird the ring-dove, must, as we shall see, be severely reckoned with.

We will take the case of mice—the field-vole and the long-tailed field-mouse—which when they have got the upper hand have been known to devastate whole districts. Mice strip off the bark of shrubs

and trees, root up newly-planted seeds, gnaw roots, devastate wheat fields, and destroy young plantations. The gardener's friends who keep these vermin in check are the Kestrel-hawk or Windhover (*Falco Minunculus*) and owls, more especially the Barn Owl, the Tawny or Wood Owl, the Short-eared Owl, and the Long-eared Owl.

The Kestrel-hawk has an extraordinary keenness of vision, and swoops down unerringly on a mouse that moves in the stubble. Though a few young game birds may occasionally fall victims to this hawk, nine-tenths of its food consists of predatory mice.

Owls have been called 'lynx-eyed cats with wings,' such inveterate foes are they of the four species of mice, three voles, and three shrews, which damage our field and garden crops. The Barn Owl, the commonest and most useful species of owl, has been known when it has young to bring a mouse to her nest every twelve or fifteen minutes. Both male and female birds hunt, and besides mice they eat bats, rats, and the destructive house-sparrow. The Tawny Owl is a large brown wood species, feeding mainly on rats and mice, but not averse to beetles of the genera *Agonum*, *Abax*, *Steropus*, and *Caratus*. The Long-eared Owl feeds more often on birds than its relations do, but its ordinary food consists of rats, mice, and voles. The Short-eared Owl during the breeding season has been known to seize and catch up chickens and chase pigeons in broad daylight, but notwithstanding these freaks, as an exterminator of mice it has been pronounced to be 'far before any cat.' Every year, alas! these feathered mousers are becoming scarcer, and it would seem advisable to have them placed under the protection of the law.

One of the greatest friends of the gardener is the common starling. M. Prevost has compiled an interesting catalogue of the food consumed by this bird every month:—In January starlings feed on worms, grubs of cockchafer—a most destructive insect—and grubs in dung; in February on grubs, snails, and slugs; in March and April on grubs of cockchafer and snails; in May on grubs of cockchafer, snails, and grasshoppers; in June on flies and grubs of various flies; in July on grubs and fresh-water shellfish; in August on flies, glow-worms, and beetles; in September on green locusts, grubs of carrion beetles, and worms; in October on worms and beetles; in November and December on snails, slugs, and grubs. Starlings will hardly touch grain, and though they sometimes attack the gardener's fruit, they do so only very occasionally, and then in very small quantities. When closely examined the 'sooty starling' will be found to possess beautiful plumage of a rich black shot with purple and green, every feather being tipped with a small triangular buff or cream coloured spot, and he rivals the sparrow in ubiquity. In all parts of the British Isles and the Continent of Europe and eastwards as far as Northern India the starling is the gardener's friend. Starlings commence building in April, and place their nests in almost any site—under eaves, in dove-cots, in rock fissures, in holes in trees or banks. Usually the nest is built of straw with a few feathers intermixed, and from four to six eggs are deposited. They are excellent mimics of the cries of the sparrow, lapwing, golden plover, chaffinch, blackbird, yellowhammer, thrush, jackdaw, and swallow. In feeding they search well every inch of ground:—'As a rule they work in a straight line, and when the ground has been sufficiently looked over, the rear ranks take a short flight just beyond the front ranks, and then alight and commence work again, the front rank of course being left in the rear; but they in a short time take up a similar position and become the front rank, and so on continually until they are satisfied.' A sure plan for establishing starlings near the house is to fix small nesting-boxes on the wall. They will not fail to take possession of them.

The rook is popularly regarded as an enemy of the horticulturist and farmer, and as long ago as the reign of Henry VIII. (1532) an Act of Parliament was passed providing that every owner of land, on pain of a grievous fine, should do all he could to destroy these birds. In these days, though it is admitted that rooks damage crops, their services as insectivorous birds are accepted as a makeweight.

The chief offence of the rook is against the farmer, and may be briefly dealt with here. Rooks dig up and eat the corn he has planted as it sprouts well above the surface of the fields, they eat and knock down the corn when it is nearly or quite ripe, and they pull the corn-straws, with ears attached, out of the ricks in winter. On the other hand it must be remembered that when other food is plentiful they do not attack seed-corn. It is the spring-sown corn, not the autumn-sown corn, that suffers from the attacks of rooks. In the north of Norfolk seed-corn is effectively protected from these birds by being dressed with a mixture of tar and lime. Rooks are undoubtedly very destructive among ripe corn, but well watching the crop is an effective protection, and these birds will seldom feed to any extent on the scattered grain left on the stubbles, preferring grubs and worms from pastures. When a stack is well built, the corn straws with ears attached cannot be pulled out by birds, and in this matter the farmer's remedy is in his own hands.

The gardener urges with truth against the rook that he damages his peas and beans, digs up and eats potatoes, both the 'settings' in spring and the ripe tubers in autumn, pecks holes in turnips in winter, and rots the walnut trees. An old country rhyme says:

> 'Sow four beans as you make your row,
> One to rot and one to grow,
> One for the pigeon and one for the crow.'

Newly planted and sprouting beans are certainly liable to the attacks of these birds, and so are crops of peas, but the latter are always infested with insects, which are partly the object of the birds, and probably the rook is often blamed for the ravages of jackdaws and wood-pigeons. In severe seasons rooks will peck holes in turnips, but these roots should be taken up and pitted before the hard weather comes.

Apart from the predatory attacks already referred to, the rook renders good service to the cultivator. Let us first take the case of the destructive larvæ of the cockchafer (*Melolantha*). In 1747 whole meadows and cornfields in Suffolk were destroyed by this pest, and the farmers found it necessary to encourage colonies of rooks, which extirpated the beetle. The larvæ of the chafer have been known to eat away the roots of grass till the turf peeled away as if cut from the ground with a spade. Where rooks are plentiful such a state of things could not exist.

Passing now to the case of earthworms. So long as they are not too numerous they are of great benefit to the gardener, forming the surface soil, assimilating and mixing with it decaying vegetable matter, and keeping it fresh and sweet by boring through it and turning it up in all directions. Where earthworms are not kept in check lawns become covered with worm castings; in the kitchen gardens the seeds sown in the beds are constantly disturbed by the workings of the worms, and the growth of the roots of plants is interfered with by them. All day long in the spring rooks are pulling worms out of the ground.

The crane-fly or daddy-longlegs (*Tipula*) is another foe to grass that falls a victim to the hungry rook, and in the vegetable garden he is the most useful of scavengers. The larva of the turnip-moth (*Agrotis segetum*) which feeds on the cabbage, onion, lettuce, carrot, mangold, beet, etc., eating off the young plants as well as boring into their roots, is, with wireworms, also a pest to root crops, the favourite food of rooks. By digging round the roots they soon reduce their numbers. Rooks also eat the caterpillars which infest the foliage of oaks.

The wood-pigeon, or ring-dove (*Columba palumbus*), though one of our most attractive wood birds, is unfortunately an enemy both to gardener and farmer. It begins to nest in March or April, a second brood is reared in June, and sometimes a third in autumn. Its nest, which is flat and loosely made of twigs, is built in trees of all sorts, sometimes in hedges and bushes, and occasionally on old walls. The eggs, usually two in number, are pure white, oval in shape, smooth and glossy. The food of the wood-pigeon consists chiefly of grain, peas, beans, beechmast, acorns, seedling potatoes, turnip-tops, bulbs, seeds from freshly sown drills, young clover, seeds of the wild mustard, charlock, dock, ragweed, gooseberries, etc. These birds are especially destructive to peas, beans, clover and corn. During this century the wood-pigeon has enormously increased in numbers, owing to the destruction of falcons, its natural enemies, the increase of fir plantations, its favourite nesting ground, and the great amount of land planted with green crops, its winter food.

Quite a controversy has lately been waged as to the ill deeds of the common house-sparrow. The great majority of agriculturists and horticulturists recognize in this marauder one of their worst enemies, but here and there a voice is raised in his favour. Parochial bye-laws used to keep down the sparrow, and boys were paid from the parish and church rates for taking the eggs and killing the young of sparrows. Sparrow clubs in England are things of the past, and sparrows are increasing at an enormous rate. In America, Canada, and Australia horticultural, entomological, and agricultural societies have begun to take action against it. Gardeners and farmers there are offering prizes for the greatest number of sparrows killed and eggs destroyed, and are destroying them wholesale by poisoned wheat scattered on the roads. Seventy-five per cent. of the food of sparrows has been proved by a course of dissections to be grain, a fact which sufficiently explains the farmer's enmity.

Let us now see what the horticulturist has to say on the matter.

First let us take the case of fruit trees. During the winter the sparrows do them an immense amount of injury by picking out their buds, especially in the case of gooseberry bushes, red currant bushes, cherry and pear trees. They pull the blossoms of peach trees and black currant bushes to pieces, apparently from pure mischief. When fruit is ripening they peck it, especially figs, plums, apples, pears, and peaches. In the vegetable garden the sparrow ravages the pea crop throughout its entire growth, attacks young lettuces and early cabbages, nips off young beetroot leaves, devours the young leaves of spinach. In the flower garden it destroys crocuses and primroses out of pure wantonness, and it is difficult to grow mignonette where this bird abounds.

Besides these direct injuries inflicted on the horticulturist and farmer, the pugnacious sparrow drives away many useful insectivorous birds, especially swallows, the great friends of the cultivator. Swallows feed wholly on insects—midges, Hessian fly, aphides, turnip flea-beetles, etc.—and the frequent occurrence lately of hop blights from aphides is attributed to their comparative paucity. Martins, fly-catchers, water wagtails, all insectivorous birds, are driven away by sparrows. Sparrows, too, are fond of the larvæ of the *Coccinellidæ*, great devourers of aphides.

It is urged on behalf of the sparrow (i.) that a large proportion of grain eaten by the sparrow is scattered on the ground after harvest, and if left there by sprouting would exhaust the land; (ii.) that the great enemies of pea and bean crops are not sparrows, but small *Sitones* weevils, little beetles which chip the margins of leaves right down to the midrib; (iii.) that the sparrow destroys mischievous insects. In rejoinder it is maintained by the opponents of the sparrow that it is only during the very early stages of its nestlings' existence that it feeds them on aphides and other insects, and that it never attacks such common depredators as the wireworm, turnip nigger, gooseberry grub, and larvæ of moths. Hairy caterpillars are never touched by them. In fact the sparrow is a vegetarian, rarely touching insect food.

The thrush tribe, sweet songsters though some of them are, eat a good deal of fruit, and market gardeners find it necessary to protect their crops with netting. On the other hand, the main food of the song-thrush, missel-thrush, and blackbird consists of worms, slugs, snails, grubs, and wild berries. The blackcap, robin, garden warbler, whitethroat, also attack small garden fruits, especially currants and raspberries, but they keep down caterpillars and other insects. The wheatear, the wagtail, the pipit, the redstart, are all purely insectivorous birds.

Formerly tits were supposed to be injurious to the gardener's crops, and head money used to be paid in some parishes for them. It has, however, been proved that the blue titmouse only picks open certain of the buds of trees, viz., those which are infected by insects. Its food consists almost exclusively of insects, and it seldom touches seeds or vegetable matter. The greater titmouse feeds on seeds in winter, and the marsh titmouse is extremely fond of the seeds of that foe to horticulturists, the thistle. The tomtit feeds its young with the small larvæ of the gooseberry moth, aphides, and the grubs of wood-boring beetles, including *Scolytus destructor*, a great enemy to the elm, and on maggots from the round galls so often seen on young oaks.

The corn-bunting in the autumn haunts stubble fields picking up grain, and in severe weather will

pull corn straws from badly built ricks; but it will eat cockchafers, and its young are fed on insects. In summer insects form the staple food of the yellow bunting or yellow hammer, a bird that consumes the seeds of many troublesome weeds—*e.g.*, the knotgrass (*Polygonum aviculare*), and the creeping persicaria (*Polygonum convolvulus*).

Passing to the finches, the chaffinch is very fond of certain newly sown and sprouting garden seeds, and the cultivator should protect the newly sown seeds of mustard, cabbage, radish, etc. On the other hand it destroys in this way many noxious weeds—*e.g.*, the wild radish, wild mustard, and charlock. Our most insectivorous finch is the piefinch, which catches insects on the wing, and is also especially fond of caterpillars. The bramble finch devours the seeds of the knotgrass, and the goldfinch, when not destroying insects, lives almost entirely on the seeds of troublesome pests to the horticulturist, viz., the groundsel, thistle, plantain, and dock. The hawfinch is fond of green peas, but its staple diet is the kernels of fruits, especially haws. The greenfinch is certainly rather a troublesome visitor in the garden. It is extremely fond of the seeds of turnips and of sunflowers. Bullfinches are enemies to fruit trees in early spring, eating a large number of their buds. Plum trees, pear trees, and gooseberry bushes suffer mostly from their ravages, but it must be remembered that these trees are often incapable of carrying and maturing all the fruit blossoms borne upon them. Again, bullfinches consume the seeds of many noxious weeds—*e.g.*, dock, thistle, groundsel, and plantain. Linnets are also consumers of these weeds, exhibiting special favour for the seeds of the dock.

To recapitulate, we have seen that—

(i.) The kestrel hawk and the owl are gardeners' friends who keep in check rats, mice, voles, and shrews.

(ii.) The starling is a most valuable insectivorous bird, feeding on worms, grubs, snails, and slugs.

(iii.) The rook is an offender against the farmer's corn and the gardener's peas, beans, potatoes, and walnut trees. On the other hand, this bird is the inveterate foe of cockchafers, earthworms, daddy-longlegs, and the larvæ of the turnip moth.

(iv.) The wood-pigeon is especially destructive to peas, beans, clover, and corn, and also attacks freshly sown seeds and gooseberries.

(v.) The house-sparrow directly injures the horticulturist by its ravages in the vegetable and fruit garden, and the mischief it does to crocuses, mignonette, primroses, etc. It indirectly injures him by driving away many useful insectivorous birds, especially the swallow.

(vi.) Thrushes, blackcaps, robins, are enemies to the fruit grower, but help to keep down insect pests.

(vii.) Tits are very useful insectivorous birds, and when they pick open the buds of fruit trees it is in search of insects.

(viii.) Buntings eat cockchafers, and the yellow bunting consumes the seeds of knotgrass and persicaria, weeds which are very troublesome to the cultivator.

(ix.) The goldfinch is one of the gardener's most useful bird friends, living almost entirely on insects and the seeds of noxious weeds. The bullfinch, the chaffinch, and the greenfinch aid him by consuming the seeds of the thistle, dock, plantain, etc. On the other hand the bullfinch attacks his fruit, the chaffinch his newly sown seeds, and the greenfinch his ripe sunflowers.

OUR 1894 CERTIFICATE CLASS.

BY DR. GEORGE BEACH, M.A.,

Author of 'Elements of English,' 'A Girls' Arithmetic,' 'Entertaining Readers,' etc.

I. MODEL ANSWERS, 1893.

Candidates are not permitted to answer more than eight questions in Algebra, and one in Mensuration.
The solution must be given at such length as to be intelligible to the Examiner, otherwise the answer will be considered of no value.
N.B.—*If more than the prescribed number of questions are attempted, only that number of answers coming first on the paper will be revised.*

ALGEBRA AND MENSURATION.

SECOND YEAR.—(MEN.)

1. Solve the equations :—

$$(a)\ 2x+17=9\sqrt{2x-1}.$$

$$(b)\ x^3+8=2x^2+11x+14.$$

$$(c)\ \begin{cases} x+6y+\frac{x}{y}=16\ ; \\ 3(x+y)+\frac{x}{y}=23. \end{cases}$$

(*a*) $2x+17=9\sqrt{2x-1}.$

Squaring :

then $4x^2+68x+289=162x-81.$

$\therefore 4x^2-94x+370=0\ ;$

$\therefore (x-5)(4x-74)=0\ ;$

$\therefore x=\underline{5 \text{ or } 18\tfrac{1}{2}}.$ Ans.

(*b*) $(x^3+8)=(2x^2+11x+14).$

The factor $(x+2)$ can be removed from each side ;

then $x^2-2x+4=2x+7\ ;$

$\therefore x^2-4x-3=0\ ;$

$$\therefore x=\frac{4\pm\sqrt{16+12}}{2}=2\pm\sqrt{7}.$$ Ans.

By equating to zero the factor $x+2$ we obtain $\underline{x=-2}$.

(*c*)
$$\begin{cases} x+6y+\frac{x}{y}=16\ ; & (1) \\ 3(x+y)+\frac{x}{y}=23. & (2) \end{cases}$$

By subtracting (2) from (1) we get

$$3y-2x=-7\ ; \quad (3)$$

$$\therefore y=\frac{2x-7}{3}.$$

Subs. value of y in (1), then

$$x+4x-14+\frac{3x}{2x-7}=16.$$

Multiply by $(2x-7)$:

then $10x^2-63x+98+3x=32x-112\ ;$

$\therefore 10x^2-92x+210=0\ ;$

$\therefore (x-5)(10x-42)=0\ ;$

$\therefore x=5 \text{ or } 4\tfrac{1}{5}.$

Subs. (1) value of x in 3, $\therefore 3y-10=-7, \therefore y=1.$

Subs. (2) value of x in 3, $\therefore 3y-4\tfrac{1}{5}=-7, \therefore \underline{y=\tfrac{7}{15}}.$ } Ans.

2. Show how the square root of $a+\sqrt{b}$, where $\sqrt{b}$ is a surd, may be found.

Simplify

(*a*) $(x-4y^{\frac{3}{2}})(x+2x^{\frac{1}{2}}y^{\frac{1}{2}}+4y^{\frac{3}{2}})(x-2x^{\frac{1}{2}}y^{\frac{1}{2}}+4y^{\frac{3}{2}}).$

(*b*) $$\frac{4+2\sqrt{3}}{\sqrt{2}+\sqrt{(2+\sqrt{3})}}-\frac{4-2\sqrt{3}}{\sqrt{2}-\sqrt{(2-\sqrt{3})}}.$$

(*a*) Required to find square root of $a + \sqrt{b}$.

Assume $\sqrt{(a+\sqrt{b})} = \sqrt{x} + \sqrt{y}$;

then $a + \sqrt{b} = x + 2\sqrt{xy} + y$;

$\therefore x + y = a$; (1)

$2\sqrt{xy} = \sqrt{b}$ (2)

∵ The square root of a rational quantity cannot be partly rational and partly a quadratic surd, and $\sqrt{b}$ is a surd.

Squaring (1) we have :

$x^2 + 2xy + y^2 = a^2$.

Squaring (2) : $4xy = b$.

Subtracting :

$x^2 - 2xy + y^2 = a^2 - b$;

$\therefore (x - y) = \pm\sqrt{a^2 - b}$;

also $x + y = a$.

From these equations we find :

$$x = \frac{a \pm \sqrt{a^2-b}}{2} \text{ and } y = \frac{a \mp \sqrt{a^2-b}}{2};$$

$$\therefore \sqrt{(a+\sqrt{b})} = \sqrt{\left\{\frac{a \pm \sqrt{a^2-b}}{2}\right\}} + \sqrt{\left\{\frac{a \mp \sqrt{a^2-b}}{2}\right\}}.$$

—Q. E. F.

(*b*) $(x - 4y^{\frac{3}{2}})(x + 2x^{\frac{1}{2}}y^{\frac{1}{4}} + 4y^{\frac{3}{2}})(x - 2x^{\frac{1}{2}}y^{\frac{1}{4}} + 4y^{\frac{3}{2}})$

$= (x - 4y^{\frac{3}{2}})\{(x + 4y^{\frac{3}{2}})^2 - (2x^{\frac{1}{2}}y^{\frac{1}{4}})^2\}$

$= (x - 4y^{\frac{3}{2}})(x + 4y^{\frac{3}{2}})^2 - (x - 4y^{\frac{3}{2}})4xy^{\frac{3}{2}}$

$= (x + 4y^{\frac{3}{2}})(x^2 - 16y^3) - (x - 4y^{\frac{3}{2}})(4xy^{\frac{3}{2}})$

$= \underline{x^3 - 64y^3}$. Ans.

(*c*) $$\frac{4+2\sqrt{3}}{\sqrt{2}+\sqrt{(2+\sqrt{3})}} - \frac{4-2\sqrt{3}}{\sqrt{2}-\sqrt{(2-\sqrt{3})}}$$

$$= \frac{4+2\sqrt{3}}{\sqrt{2}+\sqrt{\frac{3}{2}}+\sqrt{\frac{1}{2}}} - \frac{4-2\sqrt{3}}{\sqrt{2}-\sqrt{\frac{3}{2}}+\sqrt{\frac{1}{2}}}$$

$$= \frac{(4+2\sqrt{3})\sqrt{2}}{3+\sqrt{3}} - \frac{(4-2\sqrt{3})\sqrt{2}}{3-\sqrt{3}}$$

$= \frac{4\sqrt{6}}{6} = \underline{\frac{2}{3}\sqrt{6}}$. Ans.

3. (*a*) If A depends only on B and C, and if A varies as B when C is constant, and varies as C when B is constant; then when both B and C vary, A will vary as BC.

(*b*) The weight of a spherical shell is seven-eighths of what it would have been if wholly solid. Given that the weight of a sphere varies as the cube of its diameter, compare the inner and outer radii; and if the inner radius be increased by one-half, find in what ratio the weight will be reduced.

(*a*) Let $A = mBC$.

We have to show that m is constant.

Now when C is constant, $A \propto B$; $\therefore mC$ is constant.

Now C cannot involve B, since C is constant when B changes; $\therefore m$ cannot involve B.

In same manner it may be shown that m cannot involve C.

And as m does not involve B or C, it is constant.

$\therefore A \propto BC$.

(*b*) Let W = weight of a sphere of radius r.

$W = mr^3$.

Let r_1, r_2, W_1, W_2, be the radii and weights of the two spheres (*i.e.* the external one and the internal one removed).

$$\frac{W_1 - W_2}{W_1} = \frac{7}{8};$$

$$\therefore \frac{r_1^3 - r_2^3}{r_1^3} = \frac{7}{8};$$

$$\frac{r_1}{r_2} = \frac{2}{1}.$$

Let r_3, W_3 be the radius and weight of the internal one removed in second case.

$$\frac{r_1}{r_3} = \frac{2}{\frac{3}{2}} = \frac{4}{3};$$

$$\frac{W_1}{W_3} = \frac{64}{27};$$

$$\frac{W_1 - W_3}{W_1} = \frac{37}{64}.$$

Loss of weight $= (\frac{7}{8} - \frac{37}{64})W_1 = \frac{19}{64}W_1$

$= \underline{\frac{19}{64}(W_1 - W_2)}$.

4. Two boys start from the right angle of a triangular field, and run along the sides with velocities in the ratio of 13 : 11. They meet first in the middle of the hypotenuse, and again 64 yards from the starting point. Find the sides of the field.

Let x and y be sides about right angle, x being the longer.

$\therefore \sqrt{x^2 + y^2}$ = hypotenuse.

S = sum of sides.

By question :

$$\frac{S + 64}{13} = \frac{S - 64}{11}; \quad \therefore 2S = 1536, \therefore S = 768.$$

Also

$$\frac{x + \frac{\sqrt{x^2+y^2}}{2}}{13} = \frac{y + \frac{\sqrt{x^2+y^2}}{2}}{11}; \quad (1)$$

and

$$\frac{\frac{\sqrt{x^2+y^2}}{2} + y + 64}{13} = \frac{\frac{\sqrt{x^2+y^2}}{2} + x - 64.}{11} \quad (2)$$

From (1) we get :

$11x - 13y = \sqrt{x^2 + y^2}$. (3)

From (2) we get :

$11y - 13x = \sqrt{x^2 + y^2} - 24 \times 64$. (4)

By subtracting (4) from (3) we obtain :

$24x - 24y = 24 \times 64$:

$\therefore x - y = 64$; (5)

$\therefore x = 64 + y$.

Subs. value of x in (3), then :

$11(64 + y) - 13y = \sqrt{(64 + y)^2 + y^2}$.

$\therefore 11 \times 64 - 2y = \sqrt{64^2 + 2.64y + 2y^2}$.

Squaring :

$11^2 \times 64^2 - 4 \times 11 \times 64y + 4y^2 = 64^2 + 2 \times 64 + 2y^2$.

$\therefore 120 \times 64^2 - 46 \times 64y + 2y^2 = 0$;

$\therefore (y - 3 \times 64)(y - 20 \times 64) = 0$;

$\therefore y = 192$, or 1280.

Subs. value of y in (5) :

$$\left.\begin{matrix} x - 192 \\ x - 1280 \end{matrix}\right\} = 64; \quad \therefore x = 256, \text{ or } 1344.$$

Since perimeter of field = 768, ∴ values 1280 and 1344 are impossible

$$\left.\begin{matrix} \text{Sides of field are } \underline{256,\ 192.} \\ \therefore \text{Hypotenuse} = \sqrt{256^2 + 192^2} = \underline{320.} \end{matrix}\right\} \text{ Ans.}$$

5. Find the sum of an infinite number of terms of the series $a + ar + ar^2 +$, etc., in which r is numerically less than unity. In what sense is your result correct;

If x, y, z, are in harmonic progression,

$2\{z^2(y-x)^2 + x^2(z-y)^2\} = y^2(x-z)^2$.

First find the sum of n terms of the series :

$a + ar + ar^2 +$, etc., n^{th} term $= ar^{n-1}$.

Let S = sum of terms.

$\therefore S = a + ar + ar^2 + \ldots\ldots ar^{n-1}$.

Multiply each term by r, we have :

$rS = ar + ar^2 + \ldots\ldots ar^{n-1} + ar^n$.

By subtraction :

$S - rS = a - ar^n$.

$\therefore S(1 - r) = a(1 - r^n)$.

$$\therefore S = \frac{a(1-r^n)}{1-r} = \frac{a}{1-r} - \frac{ar^n}{1-r}.$$

Since r is less than unity, then the greater the value of n the smaller is the value of r^n, and consequently $\frac{ar^n}{1-r}$. ∴ by making n sufficiently large, we can make the sum of n terms of the series differ from $\frac{a}{1-r}$ by as small a quantity as we please.

∴ The sum of an infinite number of terms of a decreasing G.P. is $\frac{a}{1-r}$.—Q. E. F.

This result is true so long as $\frac{ar^n}{1-r} = 0$.

(*b*) Since x, y, z, are in H.P., $\therefore y = \frac{2xz}{x+z}$

$$2\{z^2(y-x)^2 + x^2(z-y)^2\}$$
$$= 2\left\{ z^2\left(\frac{2xz}{x+z} - x\right)^2 + x^2\left(z - \frac{2xz}{x+z}\right)^2 \right\}$$
$$= 2\left\{ z^2x^2\left(\frac{z-x}{x+z}\right)^2 + x^2z^2\left(\frac{z-x}{x+z}\right)^2 \right\}$$
$$= \left(\frac{2xz}{x+z}\right)^2\left(z-x\right)^2$$
$$= y^2(z-x)^2$$
$$= \underline{y^2(x-z)^2}.\text{—Q. E. D.}$$

6. Define *permutations* and *combinations*.

Denoting the number of combinations of n things r together by ${}_nC_r$, show that ${}_nC_r + {}_nC_{r-1} = {}_{n+1}C_r$.

Each of the *arrangements* which can be made by taking some or all of a number of things is called a *permutation*.

Each of the *groups* or *selections* which can be made by taking some or all of a number of things is called a *combination*.

$${}_nC_r + {}_nC_{r-1} = \frac{\lfloor n}{\lfloor r \lfloor n-r} + \frac{\lfloor n}{\lfloor r-1 \lfloor n-r+1}$$
$$= \frac{(n-r+1)\lfloor n + r\lfloor n}{\lfloor r \lfloor n-r+1}$$
$$= \frac{(n+1)\lfloor n}{\lfloor r \lfloor n-r+1}$$
$$= \frac{\lfloor n+1}{\lfloor r \lfloor n-r+1}$$
$$= {}_{n+1}C_r.\text{—Q. E. D.}$$

7. Obtain the expansion of $(a+b)^n$, when n is a positive integer. Find the greatest term in the expansion of $(1+3x)^{18}$ when $x = \frac{2}{5}$.

The expansion of $(a+b)^n$ is the product of n factors, each equal to $(a+b)$, and every term in the expansion is of n dimensions, being the product formed by multiplying together n letters, one taken from each of n factors. Thus each term involving $a^{n-r}b^r$ is obtained by taking b out of any r of the factors, and a out of the remaining $n-r$ factors. Therefore the number of terms which involve $a^{n-r}b^r$ must be equal to the number of ways in which r things can be selected out of n; that is, the coefficient of $a^{n-r}b^r$ is ${}^nC_r$, and by giving r the values 0, 1, 2, 3 ..... n in succession, we obtain the coefficient of all the terms. Hence

$(a+b)^n = a^n + {}^nC_1a^{n-1}b + {}^nC_2a^{n-2}b^2 + \ldots {}^nC_ra^{n-r}b^r + \ldots b^n$, since ${}^nC_0$ and ${}^nC_n$ are each equal to unity.—Q. E. F.

(*b*) Denote the r^{th}, and $(r+1)^{\text{th}}$ term by T_r and T_{r+1} respectively, then

$$T_{r+1} = \frac{18-r+1}{r} \cdot 3x \times T_r$$
$$= \frac{19-r}{r} \cdot \tfrac{6}{5} \times T_r;$$

hence $T_{r+1} > T_r$

so long as $\frac{19-r}{r} \cdot \frac{6}{5} > 1$;

that is, $114 - 6r > 5r$,

or $114 > 11r$.

The greatest value of r consistent with this in 10.

Hence the greatest term is the $\underline{11^{\text{th}}}$. Ans.

8. Define *logarithm*, and show that $\log_b x = \log_a x \times \log_b a$. Find x and y, if $m^x n^y = r$, $x : y :: p : q$.

The *logarithm* of any number to a given *base* is the index of the power to which the base must be raised in order to equal the given number. Thus if $a^x = N$, x is called the logarithm of N to the base a.

(*b*) Let $\log_b x = y$; $\therefore b^y = x$;

$\therefore \log_a(b^y) = \log_a x$.

$y \log_a b = \log_a x$;

$\therefore y = \log_a x \times \frac{1}{\log_a b}$;

$\therefore \log_b x = \log_a x \times \frac{1}{\log_a b}$. (1)

Subs. in (1) a for x,

then $\log_b a = \log_a x \times \frac{1}{\log_a b}$;

$\because \log_a a = 1$, $\therefore \log_b a = \frac{1}{\log_a b}$.

Subs. value of $\frac{1}{\log_a b}$ in (1), $\therefore \log_b x = \log_a x \times \log_b a$.

Q. E. D.

(*c*) $\begin{cases} m^x n^y = r; & \therefore x \log m + y \log n = \log r. \quad (1) \\ x : y :: p : q & \therefore qx = py. \quad (2) \end{cases}$

Mult. (1) by p and (2) by $\log n$ and add, then

$x(p \log m + q \log n) = p \log r$.

Since $x : y :: p : q$, $\begin{cases} \therefore x = \dfrac{p \log r}{p \log m + q \log n} \\ \therefore y = \underline{\dfrac{q \log r}{p \log m + q \log n}} \end{cases}$ Ans.

9. Find the present value of an annuity of £A, payable at the end of each of n successive years at a given rate of interest.

Let A be the annuity; R the amount of £1 in one year; n, number of years. V the required present value.

The present value of A due in 1 year is AR^{-1},

The present value of A due in 2 years is AR^{-2},

The present value of A due in 3 years is AR^{-3},

and so on.

Now V = sum of the present values of the different payments;

$\therefore V = AR^{-1} + AR^{-2} + AR^{-3} + \ldots$ to n terms

$$= AR^{-1}\frac{1-R^{-n}}{1-R^{-1}}$$
$$= A\frac{1-R^{-n}}{R-1}.\text{—Q. E. F.}$$

10. Eliminate x, y, and z, from the equations :—

$$\frac{x^4}{a^{\frac{2}{3}}b^{\frac{2}{3}}} + \frac{y^4}{a^{\frac{2}{3}}b^{\frac{2}{3}}} = mz^2;$$

$$\frac{x^{\frac{2}{3}}}{(az)^{\frac{1}{3}}} = x + y = \frac{y^{\frac{2}{3}}}{(bz)^{\frac{1}{3}}};$$

and show from the result $\left(\left(\frac{a}{b}\right)^{\frac{1}{3}} + \left(\frac{b}{a}\right)^{\frac{1}{3}} = m^{\frac{1}{6}}\right)$ that if $\frac{a}{b}$ is possible, m cannot be less than 2^9.

$$\frac{x^4}{a^{\frac{2}{3}}b^{\frac{2}{3}}} + \frac{y^4}{a^{\frac{2}{3}}b^{\frac{2}{3}}} = mz^2.$$

$$\frac{x^{\frac{2}{3}}}{(az)^{\frac{1}{3}}} = x + y = \frac{y^{\frac{2}{3}}}{(bz)^{\frac{1}{3}}}.$$

Put $z = \zeta^3$, $x = \Delta^3$, $y = \gamma^3$, $a = \alpha^3$, $b = \beta^3$,

then $\frac{\Delta^6}{\alpha^2} + \frac{\gamma^6}{\beta^2} = m\zeta^6\alpha^3\beta^3$,

$$\frac{\Delta^3}{\alpha\zeta} = \Delta^2 + \gamma^2 = \frac{\gamma^3}{\beta\zeta}.$$

Let $\frac{\Delta}{\zeta} = \lambda$, $\frac{\gamma}{\zeta} = p$; then $\frac{\lambda^6}{\alpha^2} + \frac{p^6}{\beta^2} = m\alpha^3\beta^3$,

$$\frac{\lambda^3}{\alpha} = \lambda^2 + p^2 = \frac{p^3}{\beta} = t, \text{ say};$$

$\therefore \lambda^2(\lambda^2 + p^2) + p^2(\lambda^2 + p^2) = m\alpha^3\beta^3$;

i.e. $t = m^{\frac{1}{2}}\alpha\beta$,

and $\lambda^3 = \alpha t$, $p^3 = \beta t$.

$\therefore t = (\alpha^{\frac{3}{2}} + \beta^{\frac{3}{2}})t^{\frac{3}{2}}$;

$\therefore t^{\frac{1}{2}} = \alpha^{\frac{3}{2}} + \beta^{\frac{3}{2}}$;

$\therefore (\alpha^{\frac{3}{2}} + \beta^{\frac{3}{2}}) = m^{\frac{1}{2}}\alpha\beta$;

$\therefore (a^{\frac{1}{2}} + b^{\frac{1}{2}})^3 = m^{\frac{1}{2}}a^{\frac{1}{2}}b^{\frac{1}{2}}$.

$$\left\{\left(\frac{a}{b}\right)^{\frac{1}{12}} + \left(\frac{b}{a}\right)^{\frac{1}{12}}\right\}^3 = m^{\frac{1}{2}}.$$

Eliminant $\therefore = \left\{\left(\frac{a}{b}\right)^{\frac{1}{12}} + \left(\frac{b}{a}\right)^{\frac{1}{12}} = m^{\frac{1}{6}}\right\}$

Again

$$m^{\frac{1}{6}} - 2 = \left\{\left(\frac{a}{b}\right)^{\frac{1}{12}} + \left(\frac{b}{a}\right)^{\frac{1}{12}}\right\} - 2 = \left\{\left(\frac{a}{b}\right)^{\frac{1}{24}} - \left(\frac{b}{a}\right)^{\frac{1}{24}}\right\}^2$$

= a square ;

$\therefore m^{\frac{1}{6}}$ is not less than 2;

$\therefore m$ is not less than 2^6.—Q. E. D.

MENSURATION. ($\pi = 3\frac{1}{7}$.)

1. Find the curve surface of the frustum of a cone whose top and bottom diameters are 4 and 6 feet, and slant side 8 feet.

Let a, A, be circumferences of top and bottom respectively of the frustum, h the slant height.

$$\text{Curved surface of frustum} = (a + A)\frac{h}{2}.$$

$$= \pi(4 + 6)4.$$

$$= \frac{22}{7} \times 40.$$

$$= 125\frac{5}{7} \text{ sq. ft.}$$ Ans.

2. A sphere, whose radius is $2\frac{1}{3}$ inches, is enclosed in a hollow cylinder of the same radius, whose length is equal to its circumference ; how many cubic inches are there in the remaining part of the cylinder?

Length of cylinder $= \frac{7}{3} \times \frac{22}{7} \times 2$.

Volume of cylinder $= \frac{7}{3} \times \frac{22}{7} \times 2 \times \frac{22}{7} \times \left(\frac{7}{3}\right)^2$

$= 2\left(\frac{7}{3}\right)^3\left(\frac{22}{7}\right)^2$.

Volume of sphere $= \frac{4}{3} \times \frac{22}{7} \times \left(\frac{7}{3}\right)^3$.

Volume of cylinder — Volume of sphere

$$= \left(\frac{7}{3}\right)^3 \times \frac{22}{7} \times \left(\frac{44}{7} - \frac{4}{3}\right)$$

$$= \frac{7^2 \times 22}{27} \times \frac{104}{21}$$

$$= \frac{7 \times 22 \times 104}{27 \times 3} = 197\frac{53}{81} \text{ cubic inches.}$$ Ans.

II. Model Answers 1893.

DOMESTIC ECONOMY.

Second Year.—Women.

1. What are the advantages of stewing meat, and what points must be attended to in order to make a stew successful?

The advantages of stewing meat are—

1. Economy of time ; when properly started, scarcely any attention is needed.

2. Economy of fuel ; stewing should be done at a low even temperature.

3. Economy of material ; the most sinewy and tough pieces of meat may be made by this method tender, palatable, and digestible ; every part of the meat is retained, so that nothing is lost or wasted ; scraps may be utilized, and by the addition of vegetables and seasonings very savoury dishes may be obtained at very little cost.

The points to be attended to are—

1. *Gentle* stewing.

2. Preparation and part cooking of the dish the day before it is required, so that all fat may be removed when cold.

(If the pieces of meat are slightly browned by frying before stewing, the juices will be more successfully retained.)

2. You buy 3 lbs. of neck of mutton, which you expect to last you for dinner for three days. How would you deal with it?

First Dinner.—Take two chops from the best end of the neck. Take out the bones and reserve them. Dip the chops in egg and bread-crumb, and fry in hot fat. Drain on kitchen paper and serve with a little tomato sauce.

Second Dinner.—Place half the remainder of the mutton (the best part)into boiling water (enough to cover it). Boil rapidly for five minutes, then draw the pan to one side and simmer for 1 hour, or until tender. Make a little parsley-butter, using some of the stock for the purpose.

Third Dinner.—Put in a stew-pan 1 oz. butter, when melted mix in gradually 1 oz. flour ; to this add gradually the stock from the boiled piece (about 1 pint), stirring all the time. Now cut up in small pieces the remaining meat, cooked and uncooked; add these, and also the bones before reserved, to the saucepan. A piece of turnip, carrot, and parsley may be added to flavour. Stew gently about two hours. Just before serving, put in a little tomato or a dessertspoonful of Worcester sauce.

Note.—3 lbs. of neck of mutton would serve one ordinary person more than three days, if carefully managed.

3. At what cost would you provide a cheap breakfast for a hundred children, and what should you provide?

The breakfast may consist of—

1. Oatmeal porridge, with milk and sugar.
2. A cup of tea.
3. A piece each of bread and dripping or jam.

1. The oatmeal porridge :

	s.	d.
6 lbs. of oatmeal (a little less than 1 oz. per child) at 2d. per lb.	1	0
12 quarts of milk (a little less than 1 gill each), wholesale at 9d. per gall.	2	3
6 lbs. of sugar (approximately 1 oz. per child) raw, at 2d. per lb.	1	0

2. A cup of tea.

6 gallons water ($\frac{1}{2}$ pint each)		
$\frac{3}{4}$ lb. tea ($\frac{1}{4}$ oz. to each pint) at 1s. 6d. per lb.	1	2
$1\frac{1}{2}$ lbs. sugar (a teaspoonful to each cup)	0	3

3. A piece of bread and dripping or jam.

45 lbs. bread at 1d. (nearly $\frac{1}{2}$ lb. per child)	3	9
Dripping or jam, $\frac{1}{4}$d. per child	2	1
	11	6

This amounts to $1\frac{3}{4}$d. (nearly) per child. Were this one of a regular course of cheap breakfasts, the articles would be obtained wholesale and by contract at a lower rate, the proportions would be affected by the quantities to be provided, and the varied appetites of the children would regulate amounts, so that the cost of the breakfast may be safely calculated at 1d. per head.

4. Give any useful receipts for the preservation of meat and milk in hot weather.

(*a*) To preserve meat in hot weather.

1. Keep in cool cellar and hang up, not on a dish.
2. Place inside a safe or muslin cage to keep away flies.
3. Sprinkle over it a little salt, which must be removed by wiping with a cloth when the meat is required.
4. Should the meat show signs of spoiling before the time at which it is intended to cook it, partially cook it, taking care not to let the juices escape. It will not be so good as though cooked properly, but the process may prevent further taint.

(*b*) To preserve milk in warm weather.

1. Bring the milk, while fresh, nearly to the boiling point.
2. Be especially careful that all vessels for holding the milk have been cleansed with boiling water, and afterwards allowed to go cold.
3. Keep in a very cool larder.
4. Add a very small quantity of bicarbonate of soda to the fresh milk.

5. If you bought a leg of mutton weighing 10 lbs., and roasted it, to how many sick people could you give a satisfactory dinner? What weight of meat would you give to each?

The leg of mutton, when roasted, would be reduced by about $\frac{3}{4}$ lb. or more.

The bone would reduce the weight by at least another 1 lb.

Then to serve only sick persons, the meat may only be carved from the thick and lean part of the leg. A few slices only may be cut from the under side, after the fat has been removed. About 8 slices may be taken from the best part, and 3 or 4 from the under-side. These should be nicely cut and mixed, giving to each sick person about 6 oz. (this will be the most as a rule). $5\frac{1}{4}$ lbs. of this kind of meat will then be available, and will therefore serve 14 sick persons.

6. Discuss the advantages and disadvantages of New Zealand mutton, and of the English mutton ordinariiy sold. By what method is New Zealand mutton preserved in coming to England?

(*a*) *Advantages.*

1. The chief advantage is that of cheapness. A good leg of New Zealand mutton may be obtained for 6d. per lb., while as a rule English mutton is 9d. at least, and often much more. Poor people are able to get a joint when otherwise inferior parts only would be within their reach.
2. It is well fed, tender, and the butcher reliable.

(*b*) *Disadvantages.*

1. The process of preserving it renders it a little less tasty, and causes rather more waste in the cooking.

2. It requires rather more attention in its preparation for the table, because, being frozen, it requires gradual warmth before the commencement of the cooking, and then prompt treatment to prevent the juices escaping.

3. Any other disadvantages are mainly due to prejudice; dislike to foreign meat, and an idea that the best animals are not sent to us.

(*c*) When the animals are killed they are divested of all internal parts, head, etc., wrapped in cloths, and immediately frozen. They are transferred to the refrigerating chambers on board ship, and brought to England, always being kept at the same temperature during the journey.

7. How must a sick room be ventilated, and what precautions must be taken against cold? What should be its temperature?

In a sick room the windows should be made to open top and bottom, and there should always be an open fire-place. One of the windows (the one furthest from the bed if there be more than one) should always be opened a little at the top, unless the doctor gives other orders.

Two or three times a day the door and windows should be opened for a few minutes to allow a circulation of fresh air through the room.

A fire in the room always assists ventilation.

To prevent the patient taking cold during this air-bath, a screen may be placed around the bed, or a blanket may be placed entirely over the patient, covering the head and face. In cases of bronchitis, or other diseases where an even temperature must be maintained, the blanket must not be removed until the windows and doors have been closed again for a short time.

The usual temperature of the room should be about 64°, but will be varied to suit the particular disease of the patient, and only by the doctor's direction.

8. Describe the arrangements made by the Post Office for School Savings Banks.

The Post Office authorities will issue children's savings books with name of school printed on, free of cost; strong envelopes to keep the books in, also with printed name, can be had for about ½d. each. The special account books required must be bought from the Post Office authorities, but they cost only a few shillings. The money received from the children is entered the same as any other deposit.

9. (*a*) What different ways of investing sums under £50 may be regarded as safe? (*b*) What is the highest interest that can be expected from such investments?

(*a*) (α) The safest method of investing £50 is to put it in the Post Office Savings Bank, or in Consols bought through the Post Office.

(β) A first mortgage on good freehold property whose minimum value is £75, and whose net rent (after rates, repairs, and voids are allowed for) is £4 per annum, is safe.

(γ) Corporation stock is also secure, and all the investments allowed by Court of Chancery to trustees.

(*b*) The '(β)' investment (see *supra*) would probably afford the highest interest, viz., 5 per cent., although for a large sum only 4 per cent. would be obtained.

10. If you had to furnish for yourself a bedroom and sitting-room, what sum would you need, and what would be the chief items of expenditure?

1.—*Bedroom.*

		£	s.	d.
Bed	*Iron Bedstead with spring mattress	1	10	0
	*Flock Mattress and Bolster		15	0
	*2 pairs Sheets at 5s.		10	0
	*3 Blankets at 9s. 6d.	1	8	6
	*Counterpane		7	6
	10 yds. Cretonne for Valence at 6d.		5	0
Tables	*1 Dressing Table and Drawers }	2	0	0
	*1 Toilet Stand }			
	Toilet Set		5	6
Chairs	*2 Cane-seated Chairs at 4s. 6d.		9	0
Carpet	9 yds. Kidderminster at 2s. 4d.	1	1	0
Fire-place	Small Fender		2	0
Window	*2 yds. Blind Holland at 1s. 4d.		2	8
	1 pair Lace Curtains at 6s. 6d.		6	6
		£9	2	8

2.—*Sitting-room.*

		£	s.	d.
Carpet	Linoleum, about (size of room)	1	10	0
	Kensington Square in centre		17	6
	Rug and Door Mats		12	6
Table	*Deal-topped Table		15	6
Chairs	*4 Chairs (Windsor with cushions) at 5s. 6d.	1	2	0
	*1 Easy Chair (wicker, cushioned, or American cloth)	1	1	0
Book-case	*Bookcase and Chiffonier	6	6	0
Fire-place	*Fender		8	6
	*Fire-irons		7	6
	Ash-pan (if grate not fitted)		4	6
Window	Blind and Curtains (as above)		9	2
		£13	14	2

The sum here expended is a little over £20. It is advisable, however, to buy second-hand furniture (chairs and tables), when they would cost less, that is if waited for. The other items may be reduced or increased to suit pocket, taste, size of room, etc. Carpets and bed furnishings should be bought new, and the items marked * are the most necessary.

11. (*a*) Describe fully the process of making bread, and the ingredients to be used. (*b*) Why is bread called the principal article of food, and the 'staff of life'?

(*a*) *To make bread:*—

Ingredients:—Flour, water, salt, yeast.

To make a quartern loaf, place 2¾ lbs. of flour in a bowl with a teaspoonful of salt. Make a hole in the centre, and into this pour a mixture of 1 oz. of German yeast powder dissolved in a little warm water (½ pint). Stir in a little flour from the sides and make a thin smooth batter. Sprinkle over a little flour, and cover with a cloth; allow to stand until the batter rises and cracks. Now take 1 pint of lukewarm water and gradually knead up the whole into a light dough.

Stand near the fire for about 1½ hours. Now take ¾ lb. of flour, and taking out the dough on a paste-board, work in this flour, and knead until the dough is elastic to the touch.

Put all into a greased tin, stand for about 15 minutes to start the rising, and then bake in a hot oven for about 1¾ hours to two hours, allowing the oven to cool a little as the baking proceeds.

(*b*) Because of its great and general use in the nourishment of mankind; because it forms one item of every meal we take; and because, while so essential to our food, containing all necessary elements, we never tire of it, bread is called the principal article of our food, and the 'staff of life.'

12. Tell what you know of the use to be made of *curry*, *lentils*, *cheese*, *beans*, and *dried fruit*.

Curry is the dishing up of cold meat, game, etc., in which the flavour of the dish is obtained by the addition of curry-powder. Boiled rice is generally one of the essentials to a dish of curry.

Lentils are used for soup-making, either with or without meat, and whole, or in the shape of lentil flour. The red or Egyptian lentils are mostly used for this purpose.

Cheese is used with bread as a supper or occasional meal, also to make dishes for lunch, breakfast, entrées, and supper in conjunction with macaroni, eggs, or bacon.

Beans when green are used as a vegetable. Windsor beans are taken from the shells and boiled; kidney-beans are boiled whole, and the whole pod eaten. Haricot beans are used when dry, both as a vegetable, and also as an addition to soups.

Dried fruits may be used as dessert. Much of it, as Normandy pippins, prunes, may with advantage be stewed and eaten with milk dishes, or with bread. Raisins, currants, and figs are used for the making of puddings and cakes. Lemon, orange, citron, in the form of candied peels, are used as flavourings for puddings and cakes.

III. Parsing, Analysis, Paraphrasing, for Routines.

A.—First Year.

(*a*) *First Friday* (Men). 'Passing of Arthur,' Lines 170 to 180 for Analysis. Parse *So, long, Until, man, man, had fallen, King Arthur, Then, because, nigh, field, chancel, Ocean, Lay, was, full.*

(*b*) *First Friday* (Women). 'The Princess,' Canto II., Lines 28 to 41 for Analysis. Parse *you, welcome, yourselves, aftertime, which, mingled, What! tall, We, he, climax, as, tho', were.*

CERTIFICATE ROUTINE FOR JUNE 1894 (MEN AND WOMEN, FIRST YEAR).

DAYS	FIRST WEEK.			SECOND WEEK.			THIRD WEEK.			FOURTH WEEK.		
	I.	II.	III.	I.	II.	III.	I.	II.	III.	I.	II.	III.
MONDAY	How to Make a Lesson Interesting	Study Bacon's Essays, 14, 15, 16, *or* 'Byron,' pp. 28 to 42 with notes	Euclid, Book III., Props. 16 to 24, *or* Composition and Nutritive Value of Food	Graphic Illustrations of Arithmetical Principles	Study Bacon's Essays, 17, 18, 19, *or* pp. 161 to 175 of 'Princess' (Notes)	Euclid, Book III., Props. 25 to 32, *or* Descriptions of the various stitches	The Common Faults of Child Reasoning	Analyse, etc. (*See Article*)	Euclid, Book III., Props. 32 to 37, *or* Any Needlework	Notes of a Lesson on 'Derivation of Words'	Analyse, etc. (*See Article*)	Euclid, Book II., Props. 8 to 14, *or* Diagram of a Woman's Chemise
TUESDAY	Chief Dates from 1783 to 1802	Fractional Equations *or* Repair of Underclothing	Mountain System of North America *or* Geography of Asiatic Islands	Chief Dates from 1802 to 1815	Algebraic Factors *or* Clothing Outfits	Effects of Climate on Industry, Productions, and National Character	Poetry from 1702 to 1789 *or* Lives of Great men from 1153 to 1270	Simultaneous Quadratics, *or* Removal of Grease and Ink Spots, Fruit Stains, etc.	Products and Commerce of N. America *or* Geography of Russian Asia	Chief Dates from 1066 to 1135	Geometrical Progression *or* Ventilation	Map of Ontario *or* China
WEDNESDAY	Problems on Least Common Multiple	Complex Fractions	Mensuration *or* Theory of Common Arithmetical Rules	The Metric System	Any Revision	Mensuration *or* Recitation	Most important Laws of 17th Century *or* Any Dates	Compound Proportion and Proportional Parts	Averages	Pecentages and Commission	Music — Transcription from one time to another	Lives of Great Men
THURSDAY	History from 1660 to 1689 *or* Struggles in America	Problems involving Simultaneous Simple Equations *or* Description of a Flannel Print and other Patches	River System of N. America *or* Physical Geography of China	History from 1783 to 1792	Quadratic Equations *or* Organs and Processes of Mastication and Digestion	Map of Quebec *or* Hindostan	Constitutional Affairs from 1461 to 1660	Arithmetical Progression *or* Warming and Lighting the Home	Governments of N. America *or* Political Geography of China	History from 1792 to 1800	Theory and Practice of L.C.M. and G.C.M. of Algebra *or* Diagram of a Pair of Drawers	Political Divisions of N. America *or* Physical Geography of Hindostan
FRIDAY	The Human Will	Deductions of Euclid, Book I., *or* Organs and Process of Respiration	Analyse, etc. (*See Article*)	Applications and Relations of Long, Square, and Cubic Measures	Select any Archaic or Peculiar Words in 'Coming of Arthur' *or* First half of 'Princess'	How to Conduct a Dictation Lesson	The best methods of preparing for and securing Recapitulation	Deductions of Euclid, Book II. *or* Cutting out of an Infant's Shirt	Read Rest of Notes on 'Coming of Arthur' *or* pp. 43 to 57 of 'Byron'	Notes of a Lesson on 'Spacing of Words'	Compound Interest	Read Notes on 'Passing of Arthur' pp. 33 to 47 *or* pp. 176 to 190 of 'Princess' (Notes)
SATURDAY	Musical Intervals	Examination	Deductions of Euclid, Book III., *or* Any Domestic Economy	Transposition from one key to another, *or* from the Imperfect to the Perfect Method	Constitutional changes during 17th Century	Map of Nova Scotia and New Brunswick *or* Palestine	Deductions of Euclid, Book III., *or* Any Arithmetic	The Navy during the 17th Century	Any Revision	Euclid, Book II., Props. 1 to 7, *or* Proofs of Arithmetical Rules	Composition on 'Kindness to Animals'	Musical Terms	Examination	Composition on 'He gives twice who gives quickly

CERTIFICATE ROUTINE FOR JUNE 1894 (MEN AND WOMEN, SECOND YEAR).

DAYS	FIRST WEEK.			SECOND WEEK.			THIRD WEEK.			FOURTH WEEK.		
	I.	II.	III.	I.	II.	III.	I.	II.	III.	I.	II.	III.
MONDAY	Jevons' Logic, pp. 89 to 107, *or* Cartwright's 'Mental and Moral Science'	Read 'Hamlet,' Notes on Act III., *or* 'Coriolanus,' Act V., Scenes 3, 4, 5, 6	Euclid, Book VI., first 8 Props., *or* Practise Darning	Formation of Habits and Character	Study Second Half of Notes to 'Coming of Arthur' *or* 'Spenser,' Chapter V.	Euclid, Book VI., first 17 Props., *or* Tucking, Whipping, Feather-Stitching	Notes of a Lesson on 'The Thames' to Standard III.	Deductions on Euclid, Book VI., *or* Linen Patch	Paraphrase. (*See Article*)	'Quick,' Chapter XVI.	Euclid, Book I., *or* Print Patch.	Analyse, etc. (*See Article*)
TUESDAY	As in First Year *or* Revision	Applications of Cube Root *or* Square Root	As in First Year *or* Geography of England	As in First Year *or* From 1509 to 1530	Mensuration *or* Discount, Present Worth, etc.	As in First Year *or* Political Geography of England	As in First Year *or* The Fleet from 1485 to 1603	Mental Arithmetic	As in First Year *or* Geography of New Zealand	As in First Year *or* Writers from 1485 to 1603	Theory of Decimals, especially 'Repeaters'	As in First Year *or* Climate and Inhabitants of Australia
WEDNESDAY	Analyse, etc. (*See Article*)	Variation and Proportion of Algebra *or* Choice of Food	Grammatical Peculiarities of Shakespeare	Read Notes on Act IV., 'Hamlet,' *or* Notes on Act I., 'Coriolanus'	Jevons' Logic, pp. 107 to 122 *or* Cartwright's 'Mental and Moral Science'	Quadratic Equations *or* Beverages	Mensuration *or* Any Revision	'Quick,' Chapter XIII.	The Algebraic Progressions *or* Post Office Facilities for Investments	Jevons' Logic, pp. 122 to 128, *or* Cartwright's 'Mental and Moral Science'	Logarithms *or* Apportionment of Small Incomes	Any Revision
THURSDAY	As in First Year *or* Dates from 1485 to 1530	Stocks	As in First Year *or* Sketch Maps of Leinster and Munster	As in First Year *or* From 1530 to 1547	Complex Fractions	As in First Year *or* Physical Geography of Australia	As in First Year *or* Great Men from 1485 to 1530	Mensuration *or* Stocks	As in First Year *or* Map of Leinster and Connaught	As in First Year *or* State Trials from 1485 to 1553	Clock Sums	As in First Year *or* Political Geography of Australia
FRIDAY	Permutations *or* Preparation of Food	Euclid, Book III., *or* Diagram of Woman's Night-Dress	Draw up a Routine for a Mixed Half-Time School of 200 average attendance, stating disposition of Teaching Staff	Combinations *or* Food for the Sick	Euclid, Book IV., *or* Cutting-out of a Woman's Night-Dress	Mensuration *or* Any Revision	Binomial Theorem *or* Economy of Food	Deductions on Euclid, Book IV., *or* Diagram of Boy's Shirt	Read Bacon's Essays, 29, 30, 31, *or* 'Spenser,' Chapter VI.	Binomial Theorem *or* Dietaries	Deductions on Euclid, Book III., *or* Cutting-out of Boy's Shirt	Paraphrase, etc. (*See Article*)
SATURDAY	Major and Minor Modes	Examination	Describe the characters of Ophelia *or* Volumnia	Ordinary Musical Measures	Grammar of 'Hamlet' and 'Coriolanus'	Historical Dates *or* Any Arithmetic	Repetition, Literature, and Penmanship	Diatonic and Chromatic Intervals	Lives of Great Men	Examination	Accent, Syncopation, and Musical Terms	Mensuration *or* Any Revision	Mental Arithmetic	Repetition, Literature, and Penmanship

(*c*) *Third Monday* (Men). 'Passing of Arthur,' Lines 192 to 201 for Analysis. Parse *be, be, am smitten, That, cannot, last, therefore, take, Excalibur, pride, for, how, noon, from out.*

(*d*) *Third Monday* (Women). 'The Princess,' Canto III., Lines 50 to 59 for Analysis. Parse *What, Melissa, Cyril, one, blush, than, blush, let, more, lest, Vulcans, to yield, furlough, went.*

(*e*) *Fourth Monday* (Men). 'Passing of Arthur,' Lines 240 to 249. Parse *pale, hast betrayed, rendering, like, knight, for, either, else, to lie, go, As, lief, bade.*

(*f*) *Fourth Monday* (Women). 'The Princess,' Canto IV., Lines 21 to 30. Parse *Tears, what, Rise, looking, that, no, more, Fresh, glittering, up, as, last, days.*

B.—SECOND YEAR.

(*a*) *First Wednesday* (Men). As in First Year.

(*b*) *First Wednesday* (Women). 'Coriolanus,' Act IV., Scene vi., Lines 131 to 141 for Analysis. Parse *clusters, they, That, unwholesome, when, hooting, is coming, hair, whip, as, as, pay, if, could, all.*

(*c*) *Third Monday* (Men). 'Hamlet,' Act IV., Scene i., Lines 12 to 23 for Paraphrase.

(*d*) *Third Monday* (Women). 'Coriolanus,' Act V., Scene ii., Lines 63 to 74 for Paraphrase.

(*e*) *Fourth Monday* (Men). 'Hamlet,' Act V., Scene i., Lines 188 to 200 for Analysis. Parse *Alas! Yorick, fellow, borne, times, abhorred, Here, that, be, songs, wont, one.*

(*f*) *Fourth Monday* (Women). 'Coriolanus,' Act V., Scene iii., Lines 11 to 19 for Analysis. Parse *latest, to send, whose, though, conditions, cannot, accept, to grace, only, what.*

(*g*) *Fourth Friday* (Men). 'Passing of Arthur,' Lines 240 to 249 for Paraphrase.

Fourth Friday (Women). 'Coriolanus,' Act V., Scene vi., Lines 70 to 80 for Paraphrase.

SELECTED GOVERNMENT QUESTIONS.

FIRST YEAR, MEN.

FIRST WEEK.

EUCLID.

Capital letters (excluding A, B, C, D, E, F), not numbers, must be used in the diagrams.

All generally understood abbreviations and symbols for words may be used, but not symbols of operation, such as $-$, $+$, $\times$, PQ^2, *PQ . RS.*

1. Define the terms—plane superficies, parallelogram, segment of a circle; and explain what is meant by the converse of a proposition, and by proof by *reductio ad absurdum*.

2. If two triangles have two sides of the one equal to two sides of the other, each to each, and have also the angles contained by those sides equal, they shall also have their third sides equal; and the two triangles shall be equal, and their other angles shall be equal, each to each, namely, those to which the equal sides are opposite.

What axioms are used in the proof?

3. If two triangles have two sides of the one equal to two sides of the other, each to each, but the angle contained by the two sides of the one greater than the angle contained by the two sides equal to them of the other, the base of that which has the greater angle shall be greater than the base of the other.

Explain why in the construction the angle is made on the side which is not greater than the other.

4. Parallelograms on the same base and between the same parallels are equal.

Describe a parallelogram of given perimeter that shall be equal in area to a given rhombus, the given perimeter being greater than that of the rhombus.

5. If a straight line be bisected and produced to any point, the rectangle contained by the whole line thus produced and the part produced, together with the square of half the line bisected shall be equal to the square of the line made up of half the line bisected and the part produced.

Produce a line so that the rectangle contained by the whole line produced and the part produced may be equal to a given square.

6. In any triangle the square on the side subtending an acute angle is less than the squares on the sides containing that angle by twice the rectangle contained by either of these sides and the straight line intercepted between the perpendicular on it from the opposite angle and the acute angle.

PQR is an isosceles triangle of which the sides PQ, PR are equal, and QS is drawn perpendicular to PR, then the square on QR is equal to twice the rectangle PR, RS.

7. If a straight line drawn through the centre of a circle bisects a straight line in it which does not pass through the centre, it shall cut it at right angles; and if it cuts it at right angles it shall bisect it.

If two circles cut one another, any two parallel straight lines drawn through the points of intersection to cut the circles will be equal.

8. In a circle the angle in a semicircle is a right angle; but the angle in a segment greater than a semicircle is less than a right angle; and the angle in a segment less than a semicircle is greater than a right angle.

PQR is a triangle, and QS, RT, drawn perpendicular to PR, PQ, intersect in O, and S, T are joined; the triangles QOR, SOT will be equiangular.

9. If from any point without a circle two straight lines be drawn, one of which cuts the circle and the other touches it; the rectangle contained by the whole line which cuts the circle and the part of it without the circle shall be equal to the square of line which touches it.

PQR is a triangle right-angled at R, and from R a perpendicular RS is drawn to the hypotenuse; show that the rectangle PQ, PS is equal to the square on PR.

10. If two circles intersect, and through a point of section a straight line is drawn bisecting the angle between the two diameters through that point; show that the straight line cuts off similar segments from the two circles.

11. In a quadrilateral the squares of the sides are equal to the squares of the two diagonals together with four times the square of the line joining the points of bisection of the diagonals.

12. The lines drawn from the angles of a triangle to the middle points of the opposite sides intersect in the same point.

THIRD WEEK.

ALGEBRA AND MENSURATION.

1. Find the value of $\dfrac{\sqrt{m+n}+\sqrt{m-n}}{\sqrt{m+n}-\sqrt{m-n}}$ when $n=\dfrac{2mp}{p^2+1}$, and prove that $a^{-m}=\dfrac{1}{a^m}$, $a^0=1$.

2. Simplify:

(1) $$\frac{\dfrac{1}{a^2+ab+b^2}+\dfrac{1}{a^2-ab+b^2}}{\dfrac{2a^2-2b^2}{a^4+a^2b^2+b^4}};$$

(2) $$\frac{\sqrt{a^2+1}+\sqrt{a^2-1}}{\sqrt{a^2+1}-\sqrt{a^2-1}}+\frac{\sqrt{a^2+1}-\sqrt{a^2-1}}{\sqrt{a^2+1}+\sqrt{a^2-1}}.$$

3. Show that if a quantity measures both A and B, it will measure $mA \pm nB$.

Find the Greatest Common Measure of $6a^4+5a^3b-10a^2b^2+7ab^3-2b^4$ and $12a^5+7a^4b+3a^3b^2-4a^2b^3+5ab^4-b^5$.

4. Find a multiplier which will make a given binominal surd as $\sqrt{a}+\sqrt{b}$ rational.

Reduce $\dfrac{3}{\sqrt{5}-\sqrt{2}}$ to a fraction with a rational denominator.

5. Solve the equations:

(1) $$\frac{8x-15}{27}-\frac{5x-\dfrac{2x-1}{7}}{18}-\frac{x-30}{12}=\frac{1}{36};$$

(2) $$\sqrt{x+a}-\sqrt{x-a}=\sqrt{x};$$

(3) $$\left.\begin{aligned} x^3+y^3&=1843\\ x^2-xy+y^2&=97\end{aligned}\right\}.$$

6. Extract the square root of (1) $x^6+1-4x^5+4x+6x^3+8x^2$; (2) $8-4\sqrt{3}$.

7. A man has a certain number of crowns and florins. If the crowns were florins and the florins crowns, his money would be

increased by 12s. The square of the number of crowns and the square of the number of florins together equal 296. How many crowns and florins has he?

8. The sum of the greatest and least terms in a proportion is greater than the sum of the other two.

If $a : b :: b : c :: c : d$, then $a^3 : b^3 :: a : d$.

9. Find four numbers in Arithmetical Progression, the sum of the squares of the extremes being 450, and of the means 306.

10. Two trains start from London for Birmingham, a distance of 112 miles. The first, which is a slow train, sets out at 9 a.m., and reaches Wolverton, a distance of 50 miles, a quarter of an hour after the express. The rate of the slow train is to that of the express as 1 : 2, and the express reaches Birmingham at 12.48 p.m. Find the rate of the slow train and the time of starting of the express.

11. The Geometric Mean between two numbers is 12, and the Harmonic Mean $11\frac{1}{25}$. Find the numbers.

12. How many panes of glass, each $4\frac{3}{8}$ by $3\frac{3}{8}$ inches, will be required for a window with a semicircular head, whose extreme height is 35 feet and width 14 feet? ($\pi = \frac{22}{7}$.)

13. A rectangular field contains $1\frac{1}{2}$ acres; the distance between opposite corners is $6\frac{1}{2}$ chains; find the length and breadth of the field.

14. If the sides of a right-angled triangle are in Arithmetical Progression, to what numbers are they proportional?

FIRST YEAR—WOMEN.

First Week.

ARITHMETIC.

1. (*a*) By what method would you teach Long Division to children who can work Short Division; *e.g.*, 19,874 ÷ 17?

(*b*) How would you explain the following truth:—'The value of a fraction is not altered by multiplying the numerator and denominator by the same number?'

(*c*) How would you work the following sum on the blackboard:—'If 3 men can mow 20 acres in 8 days, how many acres will 16 men mow in 12 days?' The children are supposed to have worked problems in 'Single Rule of Three' by the unitary method.

(*d*) Define, with examples:—Reduction, Measure, Complex Fraction, Proportion, Interest.

2. How much coal is required to supply 17 fires for 39 weeks, each fire consuming 1 cwt. 2 qrs. 7 lbs. of coal weekly?

3. Find by Practice the cost of a fence 6 furlongs 23 poles 1 yard long, at £91 13s. 4d. per mile.

4. If 216 qrs. 2 bus. 2 pks. of barley cost £403 15s. 8d., what will 150 qrs. 5 bus. 2 pks. cost?

5. Find the smallest length which is an exact multiple of 6 yds. 5 in., 6 yds. 2 ft. 7 in., and 8 yds. 2 ft. 11 in.

6. At a farm there were a certain number of horses worth £45 each; three times as many pigs worth £2 5s. each; six times as many cows as there were horses, worth £17 10s. each; nine times as many sheep as there were horses, worth £1 10s. each. The whole value of the animals was £1,191 15s.; how many horses were there?

7. Prove that $3 + \frac{1}{7 + \frac{1}{16}} = 3{\cdot}14159$ nearly, and find the square of 3·14159 correct to three places of decimals.

8. Reduce $\frac{5}{8}$ of £10 12s. 3d. — $\frac{2}{13}$ of £14 13s. 7d. + $\frac{1}{4}$ of £1 16s. 9d. to the fraction of £26.

9. Divide 16·0524 by ·001008, and $3882{\cdot}\dot{5}\dot{7}$ by $31{\cdot}\dot{5}\dot{6}$.

10. A circular running path is 553 yards round. Two men start back to back to run round, one running at the rate of $9\frac{1}{2}$ miles, and the other at the rate of $10\frac{1}{4}$ miles per hour. When and where will they meet for the first time?

11. At what rate per cent. per annum will £827 10s. amount to £1,073 13s. 7½d. at simple interest for $8\frac{1}{2}$ years?

12. A ship, value £13,775, is insured at 5 per cent. on such a sum that the owner in case of loss may receive both the value of the ship and the amount of the insurance. For what sum must it be insured?

Third Week.

DOMESTIC ECONOMY.

1. What dangers can you mention arising from (1) dust-bins, (2) water-cisterns, (3) sinks? Explain the precautions which should be taken to avoid them?

2. What kinds of clothing check perspiration? Give a list, and explain the bad effects of them.

3. From what plants may (1) starch, and (2) sugar be obtained respectively? Give an account of the use of starch in washing clothes, and explain the difference between hot-water starch and cold-water starch. Describe the nutritive value of sugar.

4. How could you demonstrate to a class
   (*a*) That linen conveys heat from the body more quickly than wool;
   (*b*) That warmed linen gets cool more quickly than warmed wool;
   (*c*) That linen absorbs moisture more quickly than wool;
   (*d*) That linen fibre is different in structure from woollen fibre?

5. Is clear water always fit to drink? What may water contain which is dangerous to health? How can you test water for (1) lead, (2) lime, (3) sewage? Why is hard water expensive in washing clothes? How can it be softened in large quantities?

6. A man's diet each day is as follows:—Bread, butter, milk, bacon, potatoes, cabbage, cheese, sugar, salt, and water. Say what you know of the nutritive effect of each of these substances. What kind of difference would it make if he took no cheese and substituted more potatoes?

7. How would you remove from linen (1) fruit stains, (2) ink spots, (3) iron mould?

8. How would you arrange the various pieces for the week's household wash? Which pieces would you put in the copper first, and which last, and why?

9. Describe the most suitable furniture for a cottage bedroom. In what ways have wall-papers proved injurious to health?

10. Describe, as fully as you can, the nature of the lungs, and the changes which the air undergoes in them. Show how the changes are promoted by exercise and retarded by sedentary occupations.

11. A labouring man earns 15s. a week. Describe the kind of supper which, without extravagance, his wife might cook and share with him on his return from work. What points should she attend to in order to make the meal a comfortable one?

12. What is meant by indigestion? How is it caused, and how and why should it be prevented?

SECOND YEAR—MEN.

First Week.

EUCLID.

N.B.—Capital letters (excluding A, B, C, D, E, F), not numbers, must be used in writing out the propositions.

All generally understood abbreviations and symbols for words may be used, but not symbols of operation, such as —, +, ×, PQ^2, $PQ \cdot RS$.

1. Define a right angle and a square.

If two triangles have two sides of the one equal to two sides of the other, each to each, and have also their bases equal, the angle which is contained by the two sides of the one shall be equal to the angle contained by the two sides, equal to them, of the other.

The line joining the middle points of the opposite sides of a square is at right angles to each of them.

2. Parallelograms upon the same base and between the same parallels are equal to one another.

A crossing, six feet wide, is laid with stones across a road. Show that the stones needed will be fewest when the road is crossed at right angles.

3. If the square described upon one of the sides of a triangle be equal to the squares described upon the other two sides of it, the angle contained by these two sides is a right angle.

Squares are described upon the sides of a right-angled triangle. Lines equal to the diagonals of these squares are placed together to form a triangle. Prove that this triangle is right-angled.

4. If a straight line be divided into two equal parts, and also into two unequal parts, the rectangle contained by the unequal parts together with the square upon the line between the points of section, is equal to the square on half the line.

RO bisects TQ at right angles in O. P is any point in OQ. If RP and RQ be joined, show that the square on RQ is greater than the square on RP by the rectangle contained by TP and PQ.

5. In every triangle, the square on the side subtending any of the acute angles is less than the squares on the sides containing that

angle, by twice the rectangle contained by either of these sides, and the straight line intercepted between the perpendicular let fall upon it from the opposite angle and the acute angle.

The sides of a triangle are 25, 30, and 25 feet respectively. Find the lengths of the segments into which the sides are divided by the perpendiculars let fall upon them respectively from the opposite angles.

6. If any point be taken in the diameter of a circle which is not the centre, of all the straight lines which can be drawn from it to the circumference the greatest is that in which the centre is, and the other part of the diameter is the least; and of any others, that which is nearer to the line which passes through the centre is always greater than the one more remote.

PQRS is a semicircle, of which PS is the diameter. PR is produced to V, and QR is joined. Show that the angle QRV is obtuse.

7. If a straight line touch a circle, and from the point of contact a straight line be drawn cutting the circle, the angles made by this line with the line touching the circle shall be equal to the angles which are in the alternate segments of the circle.

Two circles cut in P. Through the point P a chord is drawn in each circle touching the other circle. These chords are found to be equal. Prove that the circles are equal.

8. Inscribe a circle in a given triangle.

Show that the diameter of the circle thus inscribed is less than the least side of the triangle.

9. Describe an equilateral and equiangular pentagon about a given circle.

What addition must be made to the construction if a side of the pentagon required is to pass through a given point? How must the position of the given point be limited in order that this problem may be possible?

10. Triangles of the same altitude are to one another as their bases.

Triangles on the same base are to one another as their altitudes.

11. If four straight lines be proportionals, the rectangle contained by the extremes is equal to the rectangle contained by the means; and if the rectangle contained by the extremes be equal to the rectangle contained by the means, the four straight lines are proportionals.

PQRS and PTVW are equal rectangles placed so that P, Q, and T are in a straight line. RV produced cuts PQ produced in X. Show that PQ is equal to TX.

Third Week.

ALGEBRA, MENSURATION, AND ARITHMETIC.

(Work either Mensuration or Arithmetic, but not both).

1. Multiply $x^{\frac{3}{2}} + y^{\frac{3}{2}} + z^2 - y^{\frac{3}{2}}z - zx^{\frac{1}{2}} - x^{\frac{1}{2}}y^{\frac{3}{2}}$ by $x^{\frac{1}{2}} + y^{\frac{3}{2}} + z$, and simplify

$$\left\{\frac{a}{a-\sqrt{a^2-x^2}} - \frac{a+\sqrt{a^2-x^2}}{a}\right\} \times \left\{\frac{a}{a+\sqrt{a^2-x^2}} - \frac{a-\sqrt{a^2-x^2}}{a}\right\}.$$

2. Solve the equations—

(*a*) $\left.\begin{aligned} 3x + 4y + z &= 4 \\ x + y + z &= \tfrac{11}{8} \\ 3x + 2y &= 2z \end{aligned}\right\}$;

(*b*) $1 - \frac{7}{x-20} = \frac{7x}{2x^2-41x+20} - \frac{x}{2x-1}$;

(*c*) $\left.\begin{aligned} \sqrt{\frac{x}{y}} + \sqrt{\frac{y}{x}} &= \frac{5}{2} \\ \frac{x}{\sqrt{y}} + \frac{y}{\sqrt{x}} &= \frac{9}{\sqrt{2}} \end{aligned}\right\}$.

3. Show that $2p$ = the sum, q = the product, $2\sqrt{p^2-q}$ the difference of the roots of the equation $x^2 - 2px + q = 0$. Hence show that if a, b, are the roots of this equation, $a + c$, $b - c$, the roots of $x^2 - 2px + r = 0$, then $c^2 + 2c\sqrt{p^2-q} - q + r = 0$.

4. A shopkeeper buys £40 worth of calico from a manufacturer and retails it at a profit of £12. He again buys £40 worth, but getting 160 yards more for his money, retails it at ½d. per yard less than before, and yet makes the same profit. What price per yard did he charge?

5. Show that if an expression containing positive integral powers only of x vanishes when a is substituted for x, then the expression is exactly divisible by $x - a$.

Hence or otherwise prove that—

$$(a-b)\,a^2b^2 + (b-c)\,b^2c^2 + (c-a)\,c^2a^2 + (a-b)\,(b-c)\,(c-a)\,(bc+ca+ab) = 0.$$

6. Prove that the Arithmetic, Geometric, and Harmonic Means between any two quantities are in G.P.

Prove that if the middle term be added to each of three consecutive terms of a G.P. the resulting terms are in H.P.

7. When is one quantity said to vary (*a*) directly, (*b*) inversely as another?

A locomotive engine without a train can go 24 miles an hour, and its speed is diminished by a quantity which varies as the square root of the number of waggons attached. With four waggons its speed is 20 miles an hour. Find the greatest number of waggons which the engine can move.

8. Find the number of combinations of n things taken r at a time.

How many different throws can be made with two dice numbered as usual from 1 to 6?

9. Assuming that the coefficient of x^r in the expansion of $(1+x)^n$ is $\frac{\lfloor n}{\lfloor r \;\; \lfloor n-r}$, find the coefficient of x^r in the expansion of $(1+x)^{n+1}$.

Write down the first three and the middle terms of the expansion of $\left(\frac{x}{a} + \frac{a}{x}\right)^{2n}$.

10. Define the terms 'logarithm,' 'characteristic,' 'mantissa.'

Why is the characteristic omitted in tables calculated to the base 10?

Having given $\log_{10}2 = \cdot30103$, $\log_{10}3 = \cdot47712$, find $\log_{10}4050$ and $\log_{10}\cdot00405$.

11. Find the amount of £P in n years at 100 r per cent. compound interest.

Show that a sum of money allowed to accumulate in the 2½ per cents. will more than double itself in 29 years.

N.B.—$\text{Log}_{10}4\cdot1 = \cdot61278$, the other logarithm required can be found from the preceding question.

12. A cone and hemisphere have equal bases and equal volumes; find the ratio of their heights.

13. One quarter of the volume of a cylindrical boiler 12 ft. long and 5 ft. in diameter internally is fitted with cylindrical heating tubes fitted longitudinally and 7½ in. in diameter. Find the number of tubes and the ratio of the total heating surface to the surface of the boiler.

14. A prismoidal tub has a rectangular base 2 ft. by 1 ft. and a top 2 ft. 9 in. by 1 ft. 9 in. and is 18 in. deep. Find how much water it contains, having given that a cubic foot of water weighs 1,000 oz. and a gallon weighs 10 lbs.

15. Find the value of

$$\frac{\cdot461538 \times 29\cdot25}{65\cdot52 \times \cdot142857} \text{ of 2 cwt. 1 qr. 8 lbs.}$$

16. Define the terms Present Worth, True Discount, Bankers' Discount.

The difference between the true and the bankers' discount on a sum of money due at the end of 2 years and 8 months at 3¾ per cent. per annum simple interest is £7 5s. 7½d. What sum is due?

17. Find the compound interest on £2,666 13s. 4d. for 4 years at 2½ per cent. compound interest.

18. A minute of latitude contains 6,080 ft. and a metre is the ten-millionth part of a quadrant of the meridian.

A kilogramme is the weight of the one-thousandth part of a cubic metre of water, and a cubic foot of water weighs 1,000 oz. Express a kilogramme in ounces to two places of decimals.

SECOND YEAR, WOMEN.

First Week.

ARITHMETIC AND ELEMENTARY ALGEBRA.

1. (*a*) Explain, as to a class beginning Least Common Multiple, the method of finding the Least Common Multiple of 7, 15, 28, 40, and 105.

(*b*) How would you prove that ⅓ of ⅜ = ⅛, and that $\cdot3 \times \cdot2 = \cdot06$.

(*c*) Some girls in Standard VII. are beginning percentages; how would you work, on the blackboard, the following sum before

them:—An article was sold for 4s. 8d. at a gain of 12 per cent. What did it cost?

(*d*) Define Greatest Common Measure, Discount, Average, Stocks, with examples.

2. One hundred and seventy-four men are employed on a piece of work, and each of them receives 4s. 4d. per day; if eighteen of them fall ill, and their daily work and wages are divided among the others, what will be the daily wages of each of the men who do the work?

3. Find, by Practice, the value of 63 acrs. 3 rds. 24 pls. 15 yds. at £393 5s. per acre.

4. If 15 tons 6 cwt. 84 lbs. cost £158 9s. 9d., what will 14 cwt. 14 lbs. cost at the same rate?

5. Simplify $1\frac{1}{14}$ of $\frac{2}{125} \div (\frac{47}{343}$ of 9); and $\frac{11{\cdot}2 \times 1{\cdot}1\dot{3}\dot{6}}{31{\cdot}8\dot{1}}$.

6. Express 1 hr. 16 mins. 23½ secs. as the decimal of 4 hrs. 27 mins. 22½ secs.

7. A square field contains 13 acrs. 1 rd. 12 pls. 23 yds.; find the length of each side in poles and yards.

8. A man buys 18 houses for £11,196; he repairs them, and lets each house for £27 12s. 6d. per annum, thereby getting a return of 4¼ per cent. per annum on his money. What did he spend on repairs?

9. If 3 men can do as much work per day as 5 women, and a boy half as much as a man, and if, after working a certain number of days, the aggregate wages of 6 men, 12 women, and 8 boys be £22 18s. 8d., how ought the money to be divided in proportion to the actual work done by each?

10. If the true discount on a sum, due 4½ years hence, at 4½ per cent. per annum simple interest, is £162, find the sum.

Find also the exact compound interest on the true discount (£162) for 2 years at 3 per cent.

11. Goods, value £388 12s. 3d., are insured for a year at 3¼ per cent. on such a sum that the owner, in case of loss, may receive both the value of the goods and the amount of the insurance paid. For what sum must they be insured?

12. Which is the better investment, a 4 per cent stock at 127, or a 2 per cent. at 70?

What sum must be invested in the former to derive an income of £294 4s. 8d.? (Neglect brokerage.)

13. Simplify $9(3a - b)(3a + b) - 7(2a + b)^2 + 3(2a - 3b)(a + 4b)$; and divide $x^7 - 13x - 30$ by $x^2 - 2x + 3$.

14. Prove that the difference between the cube of the sum of any two numbers and the sum of their cubes is equal to three times their product multiplied by their sum.

Prove also that $(x^2 + yz)^2 + (y^2 + zx)^2 + (z^2 + xy)^2 - (yz + zx + xy)^2 = x^4 + y^4 + z^4$.

15. Reduce to lowest terms $\frac{78a^5b^4c^2}{91a^6b^3c^3}$ and $\frac{a^2 - 5ab + 6b^2}{a^2 - 4b^2}$;

and simplify $\frac{2b}{(a - 2b)^2} - \frac{a - b}{a^2 - 5ab + 6b^2} + \frac{2}{a - 3b}$.

16. Solve the equations:—

(1) $\frac{x + 6}{4} - \frac{16 - 3x}{12} - 4\frac{1}{6} = 0.$

(2) $\frac{1}{2}\left[x - \frac{1}{3}\left\{x - \frac{1}{4}\left(x - \frac{x}{6}\right)\right\}\right] = 53.$

(3) $\frac{1}{27}(2x + 7) - \frac{1}{15}(2x - 7) + \frac{1}{20}(3x + 4) = 1\frac{5}{6}.$

THIRD WEEK.

1. Give general directions for cooking green vegetables.

2. Name the ingredients and describe the method of making (1) potato pie, and (2) an Irish stew.

3. What points would you notice in choosing a piece of beef?

4. Give directions for boiling a joint of beef. Explain the varying degrees of heat suited to each part of the process. How much per lb. does meat lose (1) in roasting, (2) in boiling, and (3) in baking.

5. What are the advantages and disadvantages of cooking by gas?

6. What kind of food would you supply to a person suffering from a fever? What foods are then injurious? What solid animal food would you first supply to a person who has for sometime been fed upon liquid food and puddings?

7. Give practical directions for serving patients with food in the sick room. Note the more common mistakes.

8. Describe, briefly, the different kinds of grass plants from which food is made.

9. Point out some of the best modes of investing savings, and show what kind of investment ought to be avoided.

10. Say what should be the ordinary temperature of a sitting-room and of a bed-room. Is it desirable to sleep at night with the window partly open? If so, why?

CORRESPONDENCE.

We shall be pleased to reply briefly and through these columns to any SUBSCRIBER *seeking examinational information or advice, and* **Enclosing the Necessary Coupon.**

This privilege does not, of course, extend to furnishing the solutions and answers of problems. All such communications should be addressed to 'THE QUERY EDITOR.'

Replies demanding urgency will be promptly forwarded per post on the receipt of a stamped and addressed envelope, **Accompanied by the Requisite Coupon.**

A post will be saved by writing direct to DR. GEORGE BEACH, M.A., STANLEY MOUNT, MACCLESFIELD.

W.W.A. (Stamford).—Art. 73 is now only tentative and suggestive.

Q.Q.Q. (Rillington).—(1) The Scholarship marks are calculated on the maximum number attainable in all subjects. (2) Write to Department, as regulations are in a state of transition.

H.C. (Milford).—October's P.T. examination will be on the old lines.

'INNOMINATA' (Peckham Rye).—Both your drawings will count.

P.T.L. (Sheffield).—The percentage of marks required for the different classes is now not divulged.

A.H. (Sheerness).—See above.

'UNTOLD' (Burnley).—The answer was perfectly definite. Send stamped envelope.

B.B. (——).—Write to Department for Circular 347.

ASSISTANT MASTER (Bilston).—One month.

MOSES JOHN EPPS (——).—Address unknown, should communicate with us respecting certain papers gone astray.

ANSWERED PER ORDINARY POST.—A.M. (Hulme); W.R. (Addiewell); G.E.L. (Whitehaven); A.R.J.B. (Torrington); F.M. (Holyhead); W.H. (Crewe); A.A. (West Bromwich); T.W.D. (Beccles); S.L. (Tipton); S.M. (Lowestoft); R.J. (Warwick); R.W. (Wigan); 'SPON' (Winchester); W.W. (Brighton); J.W. (Macclesfield); K.C. (Wick); A.F. (Congleton); R.B. (Leek); 'CIMBRI' (Cardiff); H.H. (Edingale); S.Q. (Ashbourne); C.G. (Leicester); K.W.C. (Chelsea); C.F. (Ipswich); P.T. (Woodlesford); H.C.E. (Hartley Witney); G.W.S.D. (Maindee); L.N.S. (Burnley); A.W.D. (Newcastle, Staffs); F.F. (Newark); R.B. (Lewes); 'QUAIL' (Wellington); S.T.T. (Cambridge); V.W. (Tynemouth); E.J.J. (Aberystwyth); A.M.F. (Broxburn); H.B. (Oldham); P.W. (St. Austell); B.W.H. (Morpeth); W.H.T.P. (Southsea); P.T. (Woodlesford); G.W.S.D. (Maindee); L.S.K. (Manchester); 'QUERY' (Bull Ring); C.C. (Winchester); S.W. (Chelsea); W.N. (Bollington); H.L.M. (Saltport); R.R. (West Bromwich); D.H. (New Holland); 'ROYAL NAVY' (——); J.R. (Preston); E.T.L. (Durham); L.T. (Leith).

WELL-KNOWN TEACHERS AT WORK.

XXX.—T. CLANCY.

St. John's R. C. School, Portsmouth.

THE real strength of the N.U.T. lies in the fact that the organisation embraces all sections and classes of teachers. Before the introduction of Mr. Robert Lowe's Code, teachers were disunited and disorganised, practically unknown to each other in the same town, or, at the most, only on speaking terms. This state of things generally prevailed till the passing of Mr. Foster's Education Act. Then it was that a few energetic and far-seeing teachers, scattered up and down the country, realised to the full that if they were to prevent theorists and faddists from still further accelerating the down grade in

matters educational, they must put on one side their religious and political differences, they must insist that their practical experience should count for something, and that they must co-operate with each other for the promotion of the common good. They had to show that they refused to be utterly ignored in the shaping and moulding of the policy which was to fit the children of England for the battle of life, to enable them to hold their own with the Continental workers, and to make them capable and worthy citizens.

One who soon took a prominent position in the movement was Mr. McCarthy, who hailed from 'the West Countree,' a part of England which has given us several giants in Union work.

Under such an outspoken, fearless champion as Mr. McCarthy was—he has now gone over to the great majority—it was hardly possible for anyone to be trained without in a great measure being inoculated with zeal and enthusiasm for Union work, and thus it comes about, in no small degree, that Mr. T. Clancy, the subject of our present sketch, became imbued with that ardent desire to do his level best to knit all his fellow-teachers in the bond of union.

Mr. Clancy first saw the light in the small village of Cappawhite, County Tipperary, in March 1856. He was barely ten years old when the family fell upon evil times, and experienced what many other families in Ireland have experienced before and since—that of being evicted from the homestead, and turned out on the roadside to fare as best they might. Mr. Clancy retains a lively recollection of the suffering endured at that time, but he looks forward with hope to the near future when such scenes will for ever end.

When he was chosen last Easter by his colleagues on the Executive of the N.U.T. as one of the representatives of this country at the Irish Teachers' Annual Congress, he re-visited the scene of his nativity, and as a memento of the place, he shows with considerable pride a shillelagh of not over modest dimensions which grew not many yards from the spot where he was born.

The reception which he met with from his fellow-countrymen at the Congress can scarcely be described. In Mr. Clancy's own words, 'it was overpowering; brought my heart into my mouth, and the tears into my eyes,' Every one was anxious to know him and to speak to him, and to give him a 'Caed Mille failthe.'

His love for his native country is phenomenal. He never sings a song—and, by the way, he can sing one—unless it has some reference or other to Old Ireland. He is fully versed in its history, and is never tired of recounting the glories of its scenery and inhabitants. He is looked upon by all Irishmen in Portsmouth as the *beau ideal* of all that an Irishman should be.

When his father left Ireland, he took up his abode in Plymouth, and there Mr. Clancy attended the schools in connection with St. Boniface R.C. Cathedral.

After serving an apprenticeship of five years as pupil teacher, he proceeded to Hammersmith (1877-8), from whence he was appointed as headmaster of the Catholic school at Portsmouth, January 1879. On his first arrival he had to work under most adverse circumstances in a very old and dilapidated building in a back street of the borough. Considerable changes for the better have been effected since then. Beautiful new schools for boys, girls, and infants; the nave and chancel of a magnificent cathedral, with bishop and clergy-house attached, have been erected in one of the principal thoroughfares in the heart of the town, close to the Park, and, in fact, with a situation unsurpassed by any other buildings in Portsmouth.

The interior of the school is no less pleasing than the exterior. The lighting and ventilation, the sanitary and heating arrangements, are admirable. It is generally taken for granted, and for the most part admitted by Catholic teachers and managers, that the Catholic schools of the country are among those which are least blessed with a plethora of riches, and that evidences of the prevailing poverty existing among the children are plainly visible to the casual observer. This is not so in Mr. Clancy's school. The children are much like those to be seen in other elementary schools, and come from homes averaging in comfort the homes of the majority of children. Among the boys may be seen the sons of men who have risen to the proud position of commissioned officers in her Majesty's army, and side by side with them children of the humblest pensioner. His scholars have also included the children of town councillors and members of the School Board.

His school may truly be said to be a cosmopolitan one. Here, you have several children born in India; there, some who claim the West Indies as their place of birth; while others hail from Cape Colony and Canada; and not a few, as may be supposed, are proud to acknowledge themselves as Irish born.

The religious difficulty has been proved here, as elsewhere, to be only a bogey conjured up by politicians for their own ends, for on more than one occasion Mr. Clancy has had under his charge the children of Protestant parents. It is a real pleasure to notice the kindly manner of Mr. Clancy with his boys. The usual practice adopted by him in the school is to call them by their Christian names, and in some cases by a pet name. The good feeling which is engendered by this parental and homelike custom is abundantly shown by the prompt obedience which is rendered, and the willingness and trustworthiness which is everywhere apparent. Here is one result of a true education. Mr. Clancy does not believe that education means instruction only, but that it includes everything which tends to make children grow up to be better citizens—contented, thrifty, industrious, and law-abiding.

The singing of his boys is a real treat. They are taught from the Staff Notation, and though Mr. Clancy is careful to tell you he does not take the whole credit for their excellence in this particular subject, still we must award him a high mark of commendation. Every Saturday night the good people of Portsmouth have a first-class musical treat provided them in their beautiful Town Hall by a committee of the Town Council. On more than one occasion the choristers from the Roman Catholic Cathedral, all of whom attend Mr. Clancy's school, have been requisitioned for this entertainment, and the highest encomiums have been bestowed on their performances by the local press, as well as by private individuals.

A question which is coming to the fore more than

ever of late is: How are the Voluntary Schools to be maintained in the future? It would be well for education generally, and would, no doubt, go a long way towards the solution of the difficulty of maintaining Voluntary Schools, if the management of these institutions were popularised, as has been the case with Mr. Clancy's school. An equal number of subscribers and parents, duly elected at a properly constituted meeting, form the governing body of the school, and the happiest results have accrued.

The subscribers take a real and hearty interest in the work of the school, the parents are anxious that nothing shall be done in any way detrimental to its interests, and the managers and teachers are bound to each other by a tie which it will not be easy to break.

Many of the grievances under which teachers labour have been brought about through the pliancy, subserviency, and fear of managers.

They look upon those gentlemen who affix the mighty letters H.M.I. to their names, as persons to be conciliated and pandered to, for fear of losing some of the £ s. d. This fear has never operated with the managers of Mr. Clancy's school. The teachers possess the full confidence of the managers, and the work of the schools is much more accurately gauged by their constant supervision than can be done by two or three gentlemen coming in for a few short hours to measure up, as it were, by yard and tape the work of a whole year. Confidence begets confidence, and we find that Mr. Clancy being well supported by his managers is not at all afraid of giving utterance to truths which are not always palatable to the powers that be. The action which he has taken in a recent case of tyranny and persecution by the majority-party of the Southampton School Board, has merited and received the heartiest thanks of his colleagues on the Executive, and also of the teachers in the district.

J. Clancy

In connection with this particular case Mr. Clancy has had an experience which has most probably not occurred to any other member of the Executive, and more than likely to but very few teachers indeed. A meeting was called in South Hants to express confidence in Mr. Burrows, H.M. Inspector, whose methods of examination had been called in question by several teachers. These teachers had appealed to the N.U.T., and the outcome of the Executive's investigation was the drawing up of a report adversely criticising the reports which H.M.I. had given. In addition, the Executive determined to support the teachers by bringing the whole matter before the Department. This action of the Union was resented by the Southampton School Board and by a few teachers, who met to pass a vote of confidence in the Inspector. Having been requested by the officers of the Union to attend this meeting and there place before those assembled the salient points of the case, so that no resolution should be come to on *ex parte* statements alone, Mr. Clancy was refused a hearing, and by resolution of the meeting was called upon to withdraw, in company with three other teachers who were not in sympathy with the object of the meeting.

To show that the agitation against Mr. Burrow's was not without reason, the following extract from a Local Paper is appended:—

'Carisbrooke School Board. On Friday afternoon, Feb. 9th, Mr. R. Urry presided at the monthly meeting of the board, when the report of the special examination of Chillerton Schools, conducted in consequence of a compiaint by the master respecting the annual inspection, was received. It stated that the subject in question — English — was "thoroughly well-taught, with an intelligence rarely found in village schools," and expressed regret that Mr. Burrows did not feel himself at liberty to recommend the higher grant for discipline, which was most praiseworthy.' We believe that the special inspectors were Messrs. Sharpe and Brodie.

The bringing about of this special examination was very largely due to the investigations which Mr. Clancy made on the spot in conjunction with a colleague of his on the Executive.

With these and similar cases in his mind, Mr. Clancy delivers himself thus:—'If I were asked to put my hand upon the most serious blemish in our educational administration, I should, without hesitation, say, the insecurity of tenure with regard to the teacher's position. No man is absolutely secure. It matters little whether his character is above reproach, or his educational skill of the highest order, still he may awake one fine morning and find himself politely requested to resign his post. I do not wish to be misunderstood. I don't want to bolster up inefficient teachers. I recognize that a man or woman in charge of a school must be a capable

instructor. I also admit that teachers are bound to live good lives, setting a noble example to their pupils and their parents. But given these conditions, I state emphatically it ought to be beyond the power of any manager to dismiss such a teacher capriciously or unjustly.' Asked to give his remedy for such a state of things, he replied, 'My remedy is very simple. Let the Department insist upon satisfactory reasons for the discharge of each teacher, and also insist upon fair play to all concerned.'

Mr. Clancy is a thorough educationist, 'from the crown of his head to the sole of his foot.' He does all in his power to dignify the office of a teacher and to carry out the great responsibilities attaching to his work. The ideal which he sets before himself is best described in his own words. 'The teacher should be a pattern worthy of imitation. He will sympathize with the children under his charge so as to participate in their feelings and appreciate their wishes and wants. He will take the keenest interest in the development and culture of their intellectual faculties, and show an intense desire to promote their present and future well-being.'

The system of cramming adopted to meet the requirements of the Code receives at his hands the severest condemnation. He asks how long will it continue, and proceeds directly to answer, 'Just as long as teachers sacrifice their own convictions to the public applause or to the whims of others. The duty of reform rests with teachers themselves. They must assert the right, and maintain it by honourable means until public sentiment follows their guidance.'

Mr. Clancy is an ardent Unionist, and has been a member of the N.U.T. nearly the whole time since leaving Hammersmith.

He has filled the offices of Secretary, Treasurer, and President (twice) of the Portsmouth Association. He was first elected a member of the Executive at the Cardiff Conference, 1891, being placed first on the poll of the newly-elected members. At each succeeding election he has received an increased number of votes. He is the first and only Roman Catholic Teacher ever elected to the Executive. His presence on that body has been the means of drawing into the Union large numbers of Catholic teachers who before held severely aloof. He is constantly receiving letters from all parts of the country to use his influence to bring his co-religionists into the bond of union, and considerable success has attended his efforts in this direction.

He has addressed by request some of the largest associations in the country, and has been instrumental in establishing several new associations, which, under his fostering care, have become influential branches of the N.U.T. In him the Union has a bold and fearless exponent of its views, and teachers have a champion who is most persistent in his attempts to right those that suffer wrong.

He does not confine himself by any means to his school work, but takes a very active part in local and imperial politics. On more than one occasion he has been approached to allow himself to be nominated for a seat on the Board of Guardians and Town Council, but though refusing for the present because of lack of time, he certainly will not be lost sight of by the party with whom he works and is in sympathy.

In politics he is a strong Nationalist. During the last Parliamentary election he was in request all over the county, and made stirring appeals on behalf of his fellow countrymen. He was on more than one occasion complimented, by those who took opposite views, on the temperate and reasonable way in which he stated his view of the situation.

The proverb, 'A prophet hath no honour in his own country,' has no application in Mr. Clancy's case, as may be inferred from the fact that the teachers of Portsmouth are unremitting in their endeavours to make his seat on the Executive a secure one. In their latest appeal to the country on his behalf they say, 'So highly do we think of his abilities, that we should have nominated him this year for the Vice-Presidency of the Union. It was only at his earnest solicitation we desisted from doing so. Other Associations who know and appreciate his work were anxious to confer on him the same honour.' We believe the Association intends to take no refusal next year, and the members have made up their minds to push his candidature for the V.P. with all the energy and go they are noted for.

The good feeling exhibited towards him by his own association is the highest reward which Mr. Clancy desires. He prides himself on being fully supported by those who know him best, and though from his unique position as the only representative on the Executive of one Section of Teachers, he might now be able to secure election without the aid

ST. JOHN'S R.C. BOYS' SCHOOL.—TIME TABLE, 1893-4.

MORNING.

Duration of Lesson.	9—9.15.	9.15—9.20.	9.20—10.	10—10.40.	10.40—11.20.	11.20—11.30.	11.30—12.
Class I.	Vocabulary.	Registration.	Music.	History	Drawing.	Recreation.	Religious Instruction.
,, II.				English			
,, III.				English			
,, IV.				English			
,, V.				English			
,, VI.							
Class I.			Arithmetic	Reading	Copy Books		
,, II.			Arithmetic	Reading	Copy Books		
,, III.			Arithmetic	Reading	Copy Books		
,, IV.			Reading	Arithmetic	Copy Books		
,, V.			Reading	Arithmetic	Copy Books		
,, VI.							
Class I.	Prayers.		Arithmetic	History	Drawing.		
,, II.			Arithmetic	English			
,, III.			Arithmetic	English			
,, IV.			Reading	English			
,, V.			Reading	English			
,, VI.							
Class I.			Arithmetic	Reading	Dictation		
,, II.			Arithmetic	Reading	Copy Books		
,, III.			Arithmetic	Reading	Copy Books		
,, IV.			Reading	Arithmetic	Copy Books		
,, V.			Reading	Arithmetic	Copy Books		
,, VI.							
Class I.	Assembly.		Music.	History	Drawing.		
,, II.				English			
,, III.				English			
,, IV.				English			
,, V.				English			
,, VI.							

AFTERNOON.

Day.	Duration of Lesson.	1.30—1.40.	1.40—1.45.	1.45—2.	2—2.40.	2.40—3.20.	3.20—4.	Home Lessons.
Monday.	Class I.	Spelling.	Registration.	Mental Arithmetic.	Arithmetic	Geography	Shorthand	Recitation.
	,, II.				Arithmetic	Geography	Writing	
	,, III.				Arithmetic	Geography	Writing	
	,, IV.				Arithmetic	Writing	Geography	
	,, V.				Arithmetic	Writing	Geography	
	,, VI.							
Tuesday.	Class I.				English	Composition	Reading	Grammar.
	,, II.				Arithmetic	Writing	Reading	
	,, III.				Arithmetic	Writing	Reading	
	,, IV.				Reading	Arithmetic	Writing	
	,, V.				Reading	Arithmetic	Writing	
	,, VI.							
Wednesday.	Class I.	Prayers.			Arithmetic	Geography	Shorthand	Shorthand.
	,, II.				Arithmetic	Geography	Writing	
	,, III.				Arithmetic	Geography	Writing	
	,, IV.				Arithmetic	Writing	Geography	
	,, V.				Arithmetic	Writing	Geography	
	,, VI.							
Thursday.	Class I.				English	Composition	Reading	Mapping.
	,, II.				Arithmetic	Writing	Reading	
	,, III.				Arithmetic	Writing	Reading	
	,, IV.				Reading	Arithmetic	Writing	
	,, V.				Reading	Arithmetic	Writing	
	,, VI.							
Friday.	Class I.	Assembly.			Criticism Lesson.	Mapping	Shorthand	Arithmetic.
	,, II.					Arithmetic	Geography	
	,, III.					Arithmetic	Geography	
	,, IV.					Arithmetic	Geography	
	,, V.					Arithmetic	Geography	
	,, VI.							

N.B.—Instruction given to Pupil Teachers during the Lessons marked †
Private Study for Pupil Teachers from 9 to 12 a.m. on Thursday.

Approved on behalf of the Education Department as fulfilling the requirements of Section 7 of the Elementary Education Act, 1870.

R. WILDE,
Her Majesty's Inspector of Schools.

of the Portsmouth Teachers, he declares he would at once resign his position if he in any way forfeited their confidence, or if they desired to be represented by any other of their number.

In all matters of Union Policy, Mr. Clancy may be pronounced a Progressive.

The improvement of the teacher's position and status, and the opening up of the highest honours to those best qualified to receive them, are warmly and consistently advocated by him.

A short time in Mr. Clancy's company soon impresses one with the idea that he is a thoughtful, serious, and earnest man, one who takes a high estimate of his work and its responsibilities.

In taking leave of him, we are of opinion it will be through such men and their labours that the social problem, which looms larger and larger every succeeding day, will be successfully solved, and that by them the regeneration of the masses of the country will be effected.

EXERCISES IN FRENCH FOR CERTIFICATE EXAMINATION.

The following are translations of, and notes on, the italicised passages in the May number of the 'PRACTICAL TEACHER,' to which students are recommended to refer for the context :—

A.—NOTES ON FRENCH-ENGLISH EXERCISES.

First Year Students.

A.—(i.) En temps *de paix* = in times of peace.

No article before *paix* because it is used indeterminately and adjectively.

Ils se battaient entre eux. They fought with one another, *or*, They engaged in intestine strife.

Note that *se* is *reciprocal* here, and that the same form is used when the verb is *reflexive*.

Leur humeur indomptable les rendait inquiets = Their indomitable temper made them restless.

Notice that *rendre*, not *faire*, must be used to translate English *make* when followed by a *factitive adjective*.

(ii.) *À juste titre* = justly or deservedly.

Son climat la rend une des meilleures et des plus agréables contrées de l'Europe. Notice that *de* and *à* must be repeated before each complement.

Elle n'est sujette ni aux froids ni au chaleurs = She is subject neither to the cold nor heat.

Note the *negative* before the verb in the French when *ni* follows, thus making a double negative. Observe carefully the following sentence :—

Ni Guillaume *ni* Thomas *n'aiment* (Plural) mon frère.

(iii.) *Ce ne fut que vers le milieu du jour suivant* = *It was only*, or *it was not until*, about the middle of the following day.

Tour à tour = in turns *or* alternately. When is *tour* feminine ?

À grand' peine = with great difficulty.

Notice the words grand'mère, grand'masse, etc. The word *grand* had formerly in French but *one* form for both masculine and feminine, and grandmère, grandmasse, grandpeine, were the correct forms. In the 17th century, when it had become customary to give separate forms for the masculine and feminine, these words were regarded as mis-spelt, and the apostrophe was written to indicate an omitted *e*.

La sœur parvint à lui faire accepter un peu de nourriture = The sister succeeded in making him take a little food.

Notice *réussir* might be used here, but *not succéder*, which means *to follow after or in succession*.

The idiom used here is fully explained in the May number ; study it carefully and write others like it.

Elle se décida à retourner chez elle. She decided to return home.

Note the difference between *retourner*, *revenir*, and *rendre*, all of which, *under different circumstances*, may translate the English verb *return*.

E.g., *She returned from Paris to London* = Elle retourna de Paris à Londres.

I will return here soon = Je reviendrai ici bientôt.

We will return you your book = *Nous vous rendrons votre livre.*

(iv.) La disparition des deux enfants avait jeté celle-ci = the disappearance of the two children had thrown *the latter*, etc. Celle-là = the former (fem.)

Dans *d'inexprimables angoisses.* Why *d'* and not *des ?*

Elle était parvenue = She *had* succeeded.

Why is the participle feminine ? Collect those intransitive verbs of motion or transition which conjugate with *être* (as in the case of parvenir) and not with *avoir*.

Lorsque le président lui eut tout raconté = When the president had related everything to her.

Note that the past-anterior tense is here used, and not the pluperfect, because it follows a conjunction of time.

Elle se disposa à se rendre à l'hospice = She got herself ready to go to the hospital.

Note this further use of *rendre* (used reflexively).

Sans écouter le président = Without listening to the president.

Qui s'efforçait de la consoler = Who tried hard to comfort her.

Note that *s'efforcer* is reflexive.

D'en remettre la clef au propriétaire = to send the key (of it) to the landlord.

Se trouvait = was.

(v.) *Plusieurs jours s'étaient écoulés* = Several days *had* passed or elapsed.

Why is *écoulés* plural ? Note that reflexive verbs always conjugate with être, and that the participle agrees with the reflexive pronoun, if the reflexive pronoun be the *direct* object, not else. *E.g.*, Ces filles se sont *donné* des livres = these girls have given (to) one another some books.

Here *se* is dative, and therefore the participle does not agree with *se*, but remains invariable.

Sans que Mme. Robert eût revu le célèbre docteur = Without Mme. Robert having seen again the celebrated doctor.

Elle se trouvait à la veille de repartir = She *was* on the *eve* of departing again.

Be careful not to confound *veille* with *vieille*.

Pour remercier Dieu de sa guérison = To thank God for her cure (*guérison* is from *guérir*, to heal or cure).

Sa prière achevée = Her prayer being finished.

Here *prière* is nominative absolute, and *achevée* being attributive to *prière* agrees with it.

Une jeune fille à genoux = a girl kneeling.

Note that *jeune fille* not *fille* is the usual word for *girl*.

(vi.) Je ne possédais à peu près que les habits = I hardly possessed any clothes except those.

Dont j'étais vêtue = With which I was clad.

Why is vêtue feminine ?

Je ne l'ai jamais *quittée.* I have never let it go out of my possession. Why is quittée feminine ? Note that the verb conjugates with *avoir*, and the *direct* object *l'* (= la = montre) precedes the verb, therefore the participle agrees with this object.

Bien des fois j'ai eu froid ou faim = Many times I have *been* cold or hungry.

Note that *bien*, unlike other adverbs of quantity, takes *des* instead of *de* ; e.g., *beaucoup de fois.*

Avoir froid, avoir faim = *to be* cold, *to be* hungry.

Le reste de mon histoire ne vaut pas la peine d'être raconté = The rest of my story is not worth the trouble of being told.

Vaut, pres. tense of *valoir* = to be worth. Why *mon* histoire, seeing that *histoire* is feminine ?

Second Year Students.

(i.) *L'admiration dont elle et sa fille ne pouvaient toujours retenir l'expression* = the admiration, the expression of which she and her daughter could not always repress (keep back).

Note the position of *l'expression.* It must be placed *after* the verb because it is its object.

Il demandait à Dieu s'il serait à jamais privé = He asked God whether he would be for ever deprived.

Note that *si* = if (conditional) is never followed by the conditional mood ; but *si* = whether (an indirect interrogative) takes the conditional.

(ii.) *Les vapeurs brumeuses s'étaient dissipées dès le matin* = The hazy mists had dispersed since the morning.

Why is *dissipées* fem. plur. ?

De temps en temps = From time to time. So *de jour en jour ; d'année en année.*

Regardant toujours du côté du grand bassin.

Always looking on this side of the great pond.

(iii) *Ce qui s'était passé à la vente publique* = What had taken place at the public sale.

Tous trois étaient de retour = All three had returned ; *être de retour* = to have returned.

Seule condition à laquelle on avait voulu les recevoir = The only condition on which they would take them (as lodgers).

The article omitted before *seule* because *condition* is in apposition.

Il ne restait à la pauvre famille aucune ressource ni aucun moyen de s'en procurer = There remained to the poor family no resources nor any means of procuring any. *En* = of them, i.e., any ; *se* = for themselves, being the dative reflexive pronoun.

Pas de bois au foyer, le pain allait finir, plus de grain pour l'oiseau silencieux = No wood on the hearth, the bread was nearly exhausted, no more seed for the bird which had now ceased to sing.

(iv.) *Quelques rares peupliers au feuillage léger se dressaient* = Several rare poplars with light foliage *rose.*

Aux rameaux grisâtres = With greyish branches.

Le vert foncé des bouquets de sapins = The dark green of the clusters of fir-trees.

B.—English-French Translation.

Translation and notes on the passages set in the May number of the 'Practical Teacher.'

I.—*First Year Students.*

(i.) Il y a un miroir au fond de l'eau ; je viens de m'y voir.

Note the idiom *je viens de voir* = I have just seen.

(ii) Paul s'élança *à sa rencontre*, prit la main *que* son bienfaiteur lui tendait et la baisa avec *une* tendre reconnaissance.

À sa rencontre = literally *to his meeting. Que :* note that the objective relative, so often suppressed in English, *must be expressed in French.*

Une with an abstract noun denotes *an act of.*

(iii.) La veuve n'avait entendu que quelques mots de l'entretien qui *venait d'avoir lieu ;* elle espéra pourtant que la protection de l'excellent docteur pourrait être utile à ses enfants.

Note the idiom *venait d'avoir lieu* = had just taken place.

(iv.) La sainteté du lieu l'avait *empêchée* d'adresser la parole à la jeune fille ; mais lorsqu'elle se trouva sous la porche, elle la *remercia de* son attention polie.

What is the rule for the agreement of empêchée ?

Note that 'remercier *de*' = to thank for.

(v.) C'était l'heure du déjeuner, les tables étaient *occupées* par des voyageurs de tous les pays ; je chantai sans trop me troubler, et je gagnai un écu.

Explain the agreement of *occupées.*

(vi.) Cette résolution *venait d'être prise*, lorsque le grand chirurgien, qu'on n'avait point vu depuis plusieurs jours, entra tout à coup ; l'expression de ses traits était encore plus bienveillante et plus sereine que *d'habitude.*

Note.—Venait d'être prise illustrates the idiom for 'had just.' Why is *prise* fem. ?

II.—*Second Year Students.*

(i.) Elle *arrangea* leur petite chambre le plus proprement qu'elle put (or aussi proprement que possible) ; elle *emprunta à* ses hôtes quelques utensiles de ménage et acheta les provisions ; sa bonne mine, sa politesse affable *la firent bien venir* des marchandes.

Note the *e* after *g* before *a* and *o* in verbs ending in *-ger. Emprunter*, like most verbs of depriving, takes *à* (not *de*).

(ii.) Les deux femmes se retournèrent en jetant un cri de surprise, et aperçurent un étranger qui *venait de tourner* la haie *près de* laquelle elles *se trouvaient assises ;* il avait entendu la prière touchante de Paul, et s'approchant *de* lui, *il lui prit la tête* et tourna les yeux vers la lumière, après les avoir *examinés.*

Note.—Se trouver often translates 'to be.' *Assises*, pass. part. must agree with a substantive. *Il lui prit la tête ;* here *lui* is the *dat. of possession*, telling whose head ; the *def.* art. is usually placed before names of parts of the body.

(iii.) La prière de chaque jour *faite à haute voix* n'eut pas lieu ce jour-là ; la mère avait craint de ne pouvoir maîtriser son émotion. Ses lèvres tremblantes ne pouvaient proférer les mots dont les sons *venaient vaguement mourir* sur la bouche.

Observe the italicised words. Note that the English 'came *and died*' is translated by 'venaient *mourir.*'

(iv.) L'impression *que firent ces paroles* sur la mère et la fille est indicible. . . *Toutes* deux se précipitèrent sur l'enfant avec un cri d'amour, leurs bras enlacèrent les genoux de l'opérateur, et des larmes frequentes dirent leur félicité.

Observe the inversion *que firent ces paroles* = which these words made. Students often carelessly make *que* the *nominative*, but this can never be.

(v.) Le savant et brave docteur baisa *à plusieurs reprises* le front joyeux de l'enfant, serra dans les siennes les mains de la veuve, caressa les blondes tresses de Marguerite, et leur dit : 'Je reviendrai.'

(vi.) C'était un beau vieillard ; ses traits étaient nobles et accentués, l'intelligence et la bonté régnaient sur son large front, *qu'ombrageaient des cheveux* encore noirs, partagés au sommet de la tête et retombant en boucles naturelles sur ses épaules. Ses grands yeux noirs, vifs et doux, attiraient la confiance et l'affection ; toute sa personne enfin commandait le respect.

Notice this further illustration of the inversion with the relative.

A.—French-English Sight-Reading Tests.

I.—*First Year Students.*

(i.) L'électricité est un fluide impondéré, universellement répandu, *dont on apprécie les effets sans en connaître ni la véritable cause ni la nature.* Les Grecs connaissaient la propriété *que possèdent certains corps d'attirer, après avoir été frottés, d'autres corps légers*; mais *ils ne tirèrent aucun parti* de cette observation. Ce ne fut que vers le milieu du XVII^e^ siècle que le docteur Wall observa *pour la première fois* l'étincelle électrique. Il l'obtint *en frottant* un grand cylindre d'ambre jaune et en y portant le doigt. Chose remarquable ! il compara aussitôt l'effet *qu'il venait de produire* à celui de la foudre, et tomba aussi *du premier coup* sur la verité.

(ii.) Galvani *dut au hasard* la connaissance d'un fait qui par ses conséquences *est devenu* la source d'une théorie nouvelle d'électricité. Il fut un jour étrangement *surpris de voir les membres du cadavre d'une grenouille éprouver des mouvements convulsifs* pendant la décharge d'une machine électrique *qui se trouvait près de l'animal.* Volta, informé de ce fait, en conclut que l'électricité seule causait ce mouvement, et *qu'elle se développait d'elle-même* par le contact de deux métaux différents.

(iii.) Quant aux restes de constructions architecturales *qu'on a découverts* vers la fin du siècle passé á Palenqui et en d'autres lieux de l'Amérique centrale, *on ne sait absolument à qui les attribuer. Il y a si loin de ces ruines aux constructions des Mexicains* et des Péruviens du temps de la conquête, *qu'on ne saurait croire* que ces anciens ouvrages sont dus aux ancêtres de ces mêmes peuples, ou ils avaient bien dégénéré.

(iv.) Le microscope solaire *se compose* d'un système de verres qui projettent une lumière intense sur l'objet, et d'un système de lentilles qui en offrent l'image réelle amplifiée *d'une manière prodigieuse. On peut remplacer la lumière du soleil* par une lumière électrique. Les effets de cet instrument permettent de saisir des détails d'une petitesse effrayante, tels que l'organisation intérieure d'animaux *qui échappent à l'œil nu.*

(v.) La Cathédrale de Tolède est une des plus magnifiques églises de l'Espagne. Au dehors, *ses hautes tours d'airain* étonnent le voyageur, qui bientôt après trouve dans l'intérieur beaucoup d'autres sujets d'admiration : les *sculptures en bois* qui ornent les stalles du chœur, un grand nombre de bas-reliefs de marbre, les peintures du plafond de la sacristie, et surtout la chapelle des Rois, dans laquelle se trouve le tombeau d'Alphonse VI., qui conquit cette ville sur les Arabes. On citait, avant les révolutions qui ont agité ce pays, la chapelle *del Sagrario*, c'est à dire du trésor, comme renfermant d'immenses richesses.

(vi.) Un escalier taillé sur le flanc de la montagne conduit á de nombreuses excavations, *dont les unes* sont des citernes, *les autres* des portiques avec des siéges, ou des chambres plus ou moins vastes. On avait d'abord conjecturé que cette montagne formait une ville contenant *plusieurs milliers d'habitants ;* la chose était peu vraisemblable. Depuis on a pensé avec raison que ç'était un lieu de retraite pour les brahmines et pour ceux qu'ils initiaient à leurs doctrines.

II.—*Second Year Students.*

(i.) La découverte des aérostats avait excité d'abord la plus vive admiration ; mais cette découverte, *tout importante qu'elle était*, ne pouvait produire aucun resultat bien réel, *tant qu'on ne trouverait pas* le moyen de régler et surtout de diriger la marche du ballon. *Aussi*, dans les années qui suivirent l'invention des aérostats, plusieurs académies françaises et étrangères s'occupèrent de cet objet ; mais ce fut sans beaucoup de succès, et, *quoique plusieurs savants aient cru* qu'il était possible d'obtenir un résultat satisfaisant, les essais qui furent faits à la fin du XVIII^e^ siècle ne *répondirent pas à l'attente qu'on avait conçue*, et l'art aérostatique fut *à peu près* abandonné.

(ii.) Il ne suffisait pas à l'homme de soupçonner les *diverses propriétés de l'air, pesanteur, élasticité, compressibilité ;* il fallait acquérir la certitude que ces propriétés existaient. On y parvint au moyen des *expériences que permit de faire la machine pneumatique.* On avait remarqué que, par une aspiration forte et soutenue, on pouvait raréfier l'air contenu dans un tube, et que ce tube, ainsi privé d'une portion de l'air qu'il contenait, adhérait *assez fortement* aux lèvres de celui qui avait aspiré ou pompé cette portion. De cette remarque *naquit la première pensée* de construire une machine avec laquelle *on pût opérer le vide dans un corps creux assez grand pour contenir* les objets qu'on voudrait soumettre à la privation d'air.

(iii.) Le thermomètre consiste en un tube capillaire de verre d'un diamètre égal dans toute sa longueur. On soude à l'une de ses extrémités un petit globe, aussi de verre, *destiné à servir de reservoir* pour le mercure ou l'esprit de vin, qu'on y introduit en chauffant le tube afin d'en chasser l'air, et en le plongeant ensuite *par l'extrémité ouverte* dans l'une ou l'autre de ces substances. On conçoit que la pression de l'air atmosphérique sur l'esprit de vin ou le mercure le force à monter dans le tube, *ce qui s'opère d'autant plus aisément que le vide a été mieux formé.* Quand le tube a reçu la quantité suffisante de liquide, on ferme l'ouverture encore existante en l'exposant à une forte chaleur. Pour que le thermomètre soit bon, *il faut qu'il ne reste pas d'air dans le tube ;* car cet air, *en quelque petite quantité qu'il s'y trouvât,* empêcherait la libre dilatation du mercure ou de l'esprit de vin, *ce qui amènerait* des résultats inexacts.

(iv.) Le liquide *dont on se sert le plus communément* est le mercure ; mais quand *il s'agit d'observations* météorologiques, ou de mesurer des températures inférieures à la congélation du mercure, laquelle n'a lieu qu'à 40° au-dessous de zéro, on se sert du thermomètre à esprit de vin ou alcool. *Au surplus,* on les gradue de la même manière ; seulement on colore l'alcool avec l'orseille, *afin de le rendre plus aisé* à distinguer.

(v.) Les hommes avaient appris par des observations réitérées que l'air est un corps matériel qui, bien que très-léger, très-fluide et tout à fait invisible, peut opposer une certaine résistance à la direction d'un corps plus dense. On voulut s'assurer de la force de ce fluide, de sa densité, savoir s'il a une pesanteur appréciable, s'il peut exercer sur le corps une pression. On avait bien sur tous ces points des idées vagues, des présomptions plus ou moins fondées ; mais pour obtenir des notions positives *il fallait le secours de l'expérience,* et l'on sentait qu'en pareille matière l'expérience ne peut s'acquérir qu'à l'aide d'instruments capables n'engendrer la certitude morale ou du moins de très-fortes probabilités.

(vi.) Le fameux Franklin, voulant s'assurer que la foudre n'était qu'un phénomène électrique, plaça perpendiculairement une barre de fer, attendit que le nuages eussent passé par-dessus, et en tira des étincelles ; plusieurs corps an-électriques mis auprès de cette barre s'électrisèrent par communication. *Il fit cette expérience* à Philadelphie en 1751.

B.—English-French Sight Tests.

These passages will be translated in the July number of the 'Practical Teacher,' and the more difficult or idiomatic passages and constructions explained.

I.—*First Year Students.*

(i.) After having applied steam to navigation, it was natural to seek to apply it to journeys on land and to the carriage (*transport*) of goods and persons. It was a question of (use *s'agir de*) obtaining the same advantages, namely, saving (say *economy*) of time and lessening of expense.

(ii.) A black pattern (*dessin*, m.) printed on a green background loses all its vigour. Black printed (imprimer) on a red ground looks green. In the arrangement of a nosegay, the blue flowers must be placed by the side of the orange, the violet by the side of the yellow, and the red surrounded by foliage or white flowers. (Use *il faut*, etc.)

(iii.) Hiero, King of Syracuse, had had a golden crown made. He suspected (*soupçonner*) that much alloy had been mixed with (mêler à) the gold (in this and the following passive constructions use '*on*' *with the active voice*); he wished to clear the matter up. At first different individuals were applied to (s'adresser à), who could not answer the wishes of the prince. Recourse was then had to Archimedes.

(iv.) At the entrance of the bridge is seen (use the construction with *on*) a little temple dug (*creuser*) in the living rock. Two large blocks of stone form the roof. An inscription engraved (*graver*) on the wall names the architect Lacer ; but nothing indicates to what divinity the temple was consecrated.

II.—*Second Year Students.*

(i.) The excavations of Elephanta cannot (use *savoir* and the construction with *on*) be too much admired, when you (*on*) consider the difficulty of the undertaking, the number of workmen it has been necessary to employ, the genius of the architect, and all that in a country which the Greeks and Romans treated as barbarous. If these immense works had been raised on the soil, they would still have had the right to rouse wonder (étonner) ; but what confounds the imagination is to think that all this work has been done (*se faire*) by digging inch by inch in the living rock.

(ii.) A train consists (*se composer*) of a locomotive (the wagon which contains the boiler and all the apparatus (*appareil*) is so called), sometimes of two, and several other wagons (*same word*) yoked (*atteler*) one after another, and intended for the conveyance (*transport*, m.) of travellers and goods.

(iii.) Numerous accidents have happened, still happen every day, both on steam ships (bâtiments) and on railways. We agree that more than once they have been caused by a want (*défaut*) of foresight, or by some unforeseen accident ; but often also there has been *a running off the rails* (*déraillement*) or an explosion, in spite of all the precautions taken.

(iv.) It is by means of the hydraulic press that we (*on*) succeed (*parvenir*) in diminishing, in a surprising manner, the volume of certain objects. We have seen bundles (botte) of hay intended to be embarked reduced to the size and shape of a cannon ball.

(v.) The invention of gunpowder, which was to (*devoir*) produce a complete revolution in military tactics, was only known in Europe in the 14th, or at the earliest in the 13th century. We say in Europe, for it seems proved (avéré) that the Chinese had known of it for several centuries, and it is probable that it was from this people, with which they had once some communication, that the Arabs had learned its composition.

NOTES AND NOTIONS.

BY RICHARD WADDINGTON.

'Sence I've come hum, though, an' looked round, I think
I seem to find
Strong argimunts ez thick ez fleas, to make me change my mind.'

The veteran representatives must have been struck with the readiness of the representatives at Oxford to change their mind. Sitting on the platform one could feel the flowing tide, now east, then west. I never remember a Conference so subject to strategy. The superior culture of the 'cap and gown' seemed to have, for the moment, taken the pedagogues into the realm of antiquity. The functions formed the feature of the Conference. The reception, the dinner, the conversazione, the conferment of the degree on the President, and the visits to the colleges, all tended to leaven the usual evidence of excessive earnestness one is accustomed to at Conference. The attendance was admirable. The genial sunshine, the river, and the numerous colleges all failed to draw the representatives from the business set out in the agenda. All round the speaking was up to the usual standard. There was always a crowd of speakers anxious to catch the President's eye, 'An' let off the speeches they're ferful 'll spile.'

* * * * *

Mr. Gray carried out his difficult task with admirable tact and coolness. Whether in the Sheldonian Theatre, receiving the recognition of the University, or presiding in the examination rooms, he never made a mistake. There was a dignified impartiality in all his efforts that won the confidence of the representatives. Conference is by no means an easy body to manage, and the Oxford Conference was more critical and minute in its judgments than any I have attended. Much of the agenda was left untouched, mainly through this anxiety about details. What would have been the case had the President been less able it is difficult to tell—possibly the Balance Sheet would have taken the whole week.

* * * * *

Next year Manchester is to be re-visited after an absence of nearly a quarter of a century; and then we may find Conference at Cambridge. After the invigorating week at Oxford there is sure to be an effort made to get the Primary teachers to the University on the banks of the Cam. From a

purely business point of view the great industrial centres are the best places in which to hold the Conference; but there can be no doubt that what is lost in domestic matters is gained in the friendly intercourse of the two educational bodies, the University and the N.U.T.

* * * * *

CONFERENCE is too large for anything approaching real deliberation. It is a thousand pities that the Executive Scheme for reforming the representation was not reached. Unless something is done, the Manchester Conference is certain to be larger than the Oxford Conference. The Agenda gets heavier year by year. There is room for retrenchment in the agenda. Conference, as at present constituted, cannot hope to discuss more than three or four important phases of the educational programme. The number of representatives ought very materially to be reduced. The functions must be kept within reasonable limits. Following the example set by Mr. Macnamara, the President's address might be taken as read. And, if the work cannot be completed without, a session must be taken on Friday.

* * * * *

MR. ACLAND'S second attempt at Code-making is disappointing. All consideration for the overwrought teachers and scholars seems to have waned before the anxiety to enlarge the number of compulsory subjects. The Intermittent Inspection in the infants' schools is a hybrid sort of arrangement which will keep the teachers and scholars enveloped in all the worries and anxieties of the old arrangement, and most of the disadvantages of the new. Even when the school has had the two visits, the ordinary fixed examination may follow. How are the teachers to free themselves from the vitiating influence of the 'annual parade' under such circumstances? Better to have left matters alone until a more complete and generous step could be taken.

* * * * *

TURNING to the question of staff. Every one rejoices at the prospective improvement, but every practical teacher sees with what absurdity the 15 per cent. regulation will work. And why does Mr. Acland fail to remove the unfair distinction created by Article 73? There were not two opinions among the members of the deputation that waited on Mr. Acland a year ago. Every member of the deputation felt, I believe, that Mr. Acland would do something to wipe out the unfair distinction created. If training is so essential—and I believe it is—let us have all teachers trained. The Department is yearly deluding thousands of teachers. For full and complete certification the Department says training is essential, and yet there is not sufficient training accommodation for one-half the pupil teachers engaged with the sanction of the Department. Through no fault of their own, but because of the insufficient accommodation, one-half of these young people are drawn into a profession in which they can never attain front rank. Is Mr. Acland content to allow this to continue?

* * * * *

THE needlework schedule has undergone some reform. As the master of a mixed school, I feel sure the reform might have gone much farther with advantage. There is no doubt that hitherto only the patience of the mistresses has tolerated the excessive demands of Schedule III. Let us hope that next year will see the process of reduction taken a step further.

* * * * *

THE simultaneous course of History and Geography for pupil teachers is exactly what I suggested in 'NOTES AND NOTIONS' over a year ago. Nothing will do more to give the pupil teacher who cannot attend a 'Centre' a lift than this new scheme. Head teachers will now find it possible to do some teaching in these two subjects. And even at the 'Centres' I venture to think the simultaneous course will prove advantageous.

* * * * *

ON the question of physical training there is certain to be pretty general condemnation of the mode of its introduction. Why should it be compulsory? The boys and girls in the upper standards of my school work four or six hours a day in the factory. Do they want any more physical exercise out of the two and a half spent at school? There is no necessity to go on adding thus to the compulsory subjects. If schools are not taking up the physical training with sufficient activity, the placing of the subject on the same lines as Music would attain the object desired where possible. Proper physical training means increased expenditure on apparatus. Teachers will be called upon to add another certificate to the growing array. Is there to be no additional payment?

* * * * *

AT last the spelling craze is going. The word-building exercise of the lower standards ought to have been extended to the fourth. If the plan suggested is the best for the first three standards, it cannot be otherwise for the fourth. The presence of the unseen test in dictation in the Fourth Standard will make many teachers hesitate at adopting the more rational course in the other standards.

* * * * *

'COMPULSORY Object Lessons in the first three standards,' says the Code; and the teachers ask: 'Where is the time to take these to come from?' My plan is to drop English in the first three standards, and take Object Lessons as a class subject. An occasional lesson on English will suffice for the first three standards. By this means the Code can be met without a very large addition to the curriculum.

* * * * *

THE pupil teachers in the Bolton District have signed the following:—

'*Re* PUPIL TEACHERS' ANNUAL EXAMINATION BY HER MAJESTY'S INSPECTORS.

'We, the undersigned, in view of the stringent measures taken by H.M. Inspectors in examining the pupil teachers' yearly work, beg to submit for the consideration of the Bolton Teachers' Association the following:—

'1. That the time allowed—one day of about 6 hours—for the examination of 14 subjects is totally inadequate.

'2. That the examination, to be properly and effectively conducted and carried out, should last two days.

'3. That more questions should be set in order to judge of the thoroughness of a year's work, as it is impossible to decide an important examination on two or three questions which have to be hurriedly done.

'4. That instead of questions on five or six subjects being set on one paper, each subject should be set on a separate paper, and a specified and reasonable time allowed.

Hoping this will meet with due consideration.

'We remain,

'Yours, etc.'

To every one of the four requests every teacher must give a hearty 'hear, hear.'

* * * * *

THE last concession of the Science and Art Department ought to make every non-unionist blush for very shame. To-day I know cases where young teachers without the 'D.' would have had to seek pastures new, but for the action of the union four years ago, and to-day you cannot draw the few shillings subscription from them. Content to accept the fruits of the Union's work they sail along their selfish course until legal assistance is required, and then they are hurrying around to obtain the qualification. Practically, every teacher who was on the staff of a school in 1884 and has taught drawing for five years before December 31st 1896 and obtained good or excellent twice during that time, will receive a Drawing Certificate without examination. This is a very great tribute to Unionism. There are one or two minor points on which we hope the Department will agree; 1884 ought to read 1886. In 1886 the present form of teaching drawing by standards to the whole school was substituted for the old form of First Grade examination. Drawing was then taken as a Class Subject like English and Geography, and a school could take three Class Subjects. That was the first step to the introduction of Compulsory Drawing, and teachers up to that date ought to receive the Certificate.

* * * * *

THE Evening School Code does not meet the registration difficulties of last year. Teachers everywhere complain of the absurd waste of time in carrying on the work of registration. This has been aggravated in some districts by the rigidity of the Inspectors' ruling. The absurdity of Intermittent Inspection accompanied by a variable grant has been brought home to many teachers. The calculation of the Variable Grant on the same lines as the Fixed Grant is a step in the right direction. Many teachers have been seriously disappointed at the amount of grant paid when the calculation had to be on the basis of completed twelves. We hope, in the interests of the continuation and prolongation of the good work of the schools, that the discussion promised on the Code for 1894 will add to the Department's knowledge on the subject.

* * * * *

THE Government Factory Bill just read a first time leaves the age of the half-timer at eleven. I am surprised after the way in which Mr. Sydney Buxton, Mr. Mundella, Mr. John Morley, and Mr. Burt 'went for' the late Government three years ago for neglecting this very subject. It is to be hoped that wiser councils will prevail, and that the four year old Berlin pledge will be redeemed. In 1815 Sir Robert Peel, in introducing an amending Factory Bill that brought about the first Parliamentary Inquiry, said: 'A bad practice had prevailed of condemning children whose years and strength did not admit of it to the drudgery of occupations often severe, and sometimes unhealthy. What he was disposed to recommend was, *that no children should be so employed under the age of ten years*, either as apprentices or otherwise.' Nearly eighty years later the age stands at eleven, and even the persons who advocated twelve in 1891 make no move now the opportunity is theirs.

* * * * *

THE other evening an Inspector's Assistant had been visiting an evening school in Lancashire. As he came to enter the cab at the school door he heard two young women discussing whether they should honour him by opening the cab door. Noticing their hesitancy he said, 'Well, are you going to?' Straightway one of them opened the cab-door, and when he was inside turned to the cabby, and said, 'Prestwich'—the local lunatic asylum. Evidently they knew something of inspectors.

* * * * *

I HAVE to thank 'Brother Chip' for his kindly reminder.

LONDON MATRICULATION.

PREPARATION CLASS FOR JANUARY, 1895.

BY R. C. B. KERIN, B.A. (LOND.),
First in First-Class Classical Honours at Final; Principal, Carlyon College, Chancery Lane, W.C.,

AND E. J. SCHWARTZ, B.A. (CAMB.),
Mathematical Scholar and Honoursman in Tripos.

LATIN.

Latin Course for June.

1. Vergil Aeneid III. 592–715, with revision of lines 1–398.
2. Grammar: (α) Postgate's Latin Primer (Cassell), §§ 81–95; §§ 157–162; §§ 333–347; or (β) Allen's Latin Grammar (Clarendon Press), §§ 59–80; §§ 313–316.
3. Translation at Sight: A couple of pieces a week.
4. Bayfield: Exercises 5–24, 12–14 in each; Exercises 24–80, the 9th in each.

Notes on Latin Work.

Vergil, May and June Course. Supplementary Notes to Page. (Macmillan.)

(Lines 440 to end.)

441. *ubi accesseris* is fut. perfect indic., lit. 'when you shall have approached.' Note that the fut. perf. is often translated in English by the present. We say, 'when you approach.'

452. Students should note the verbs *memini*, *odi*, and *novi*, which are perfect in form, but present in meaning.

453. Note the jussive subjunctive, and that *ne* is the negative with the subjunctive in jussive and optative sentences.

457. Note the subjunctive *canat* depending on *poscas*.

459. *quo* to be taken with *modo*. Students should distinguish *quemque*, acc. of *quisque*, 'each'; *quemquam*, acc. of *quisquam*, 'anyone.'

461. *liceat* is consecutive subjunctive. The relative is followed by the subjunctive when the antecedent is indefinite.

472. *aptare iubebat*. The subject of *aptare* is understood.

482. *digressu*, ablative of cause.

486. *quae monumenta—sint*, 'to be memorials.' An infinitive clause in English expressing a purpose is often translated into Latin by *qui* and the subjunctive. *Qui* requires subjunctive always when it denotes *purpose* or *result*; generally when it denotes a *cause* or *concession*.

492. *lacrimis obortis*, abl. absolute.

501. *si quando intraro*, 'whenever I shall enter'; lit. 'shall have entered.'

502. *olim*, 'of yore.'

505. *animis*, either (1) abl. of cause, 'by our feelings'; or (2) abl. of respect, 'in respect to feelings,' 'in heart.'

506. *pelago*, 'on the sea,' abl. of place.

521. *stellis fugatis*, 'after putting the stars to flight, the dawn, etc.'; lit. 'the stars having been put to flight.'

523. Beginners should distinguish *primus conclamat*, 'he is the first to cry out'; *primo conclamat*, 'at first he cries out'; *primum conclamet*, 'first he cries out.'

525. *cratera*. Note the Greek accusative.

538. *candore nivali*, abl. of quality.

539. *bello*, 'for war'; dat. of purpose.

541. *curru*, dat. after *succedere*.

542. *iugo*, instrumental ablative.

544. *quae prima*, 'who was the first to,' etc.; as above, l. 528.

550. *graiugenumque*, gen. pl. in *-um* of first declension.

564. *curvato gurgite*, abl. of instrument.

570. *horrificis ruinis*, abl. of attendant circumstances.

581. *mutet*. The subjunctive is due to *oratio obliqua*.

584. *quae—det*. This is a dependent question, hence subjunctive.

591. *polo*, abl. of separation, after *dimoverat*.

594. *cetera*. Students must not imitate this accusative of respect in turning English into Latin.

596. *isque*. Note that *que*, *ve*, *ne* (interrogative particle) are *enclitics* in Latin, and do not stand by themselves. The preposition *cum* is sometimes an enclitic, as in *mecum*, *tecum*, &c.

601. *terras*, poetical acc. expressing 'motion to' without a preposition.

608. *qui* when interrogative is generally used as an adjective, while *quis* is used as a substantive. The subjunctive *sit* is due to the dependent question.

615. *mansissetque utinam fortuna*. A wish referring to the past is expressed by *utinam* and the pluperfect subjunctive. This may be translated in English by 'I wish that fortune had remained.'

616. *dum—linquunt*. *Dum*, 'while,' is in Latin followed by the present indicative where we use a past tense.

620. *terris*, 'from the earth,' abl. of separation.

621. *ulli* is the dat. of the agent after the verbal in *-bilis*.

622. *vescitur*. See grammar for the other deponents that govern the ablative.

627. *manderet*. Distinguish *mando*, *mandare*, and *mando*, *mandere*.

629. *oblitusve*. Distinguish *oblĭtus* (*obliviscor*) and *ōblĭtus* (*oblino*). The genitive *sui* is due to the verb of 'forgetting.'

658. *cui lumen*, lit. 'from whom the eye had been taken away.' The verb *adimo* is followed in the active by an accusative of the thing taken away, and the dative, or ablative with a preposition of the person, from whom the thing is taken away.

672. *quo*, ablative of cause.

The places mentioned should be looked up in an atlas.

Latin Grammar Notes.

The irregular and defective verbs are most important. Note in *possum* that the *t* of *pot* appears before a vowel, but in other cases is assimilated to *s*. Note that the imperf. subj. is contracted to *possem*. Note the absence of imperatives in *volo* and *malo*. Distinguish *vēlis*, dat. or abl. plural of *velum*, 'a sail,' from *vĕlis*, pres. subj. 2nd sing. of *volo*. Note in *fero* the dropping of the vowel in the 2nd and 3rd sing. and 2nd pl. of the pres. indicative. The imperfect subjunctive also is without the vowel, *e.g. ferrem*, not *fererem*. Note that *fio* is used as the passive of *facio*, *pereo* as the passive of *perdo*, *veneo* as the passive of *vendo*. Distinguish *ĕdo* (eat), *ēdi*, and *ēdo* (give out), *ēdidi*. The defective verbs *aio*, *inquam*, *coepi*, *odi*, &c., are important. *Memini* is the only verb which has an *imperative* formed from the perfect. Note that *coepi* is normally used before an active inf., and *coeptus sum* before a passive inf., as *urbem aedificare coepi*, and *urbs aedificari coepta est*. Distinguish the old imperative *cĕdo*, 'give,' from *cēdo*, *cessi*, &c., 'to yield.' Note the formation of Inceptive, Desiderative, Frequentative, and Diminutive verbs. In the Pronouns note the different ways of translating *anyone* or *someone*. Note the usages of *quis*, *aliquis*, *quispiam*, *ecquis*, *numquis*, and *quisquam*. Distinguish *quisque*, 'each,' *quisquis*, 'whoever,' and *quisquam* 'anyone'; *quivis*, 'anyone you like,' inclusive, and *quisquam*, 'anyone,' exclusive. Note the use of *quidam*, 'a certain one,' which implies that the person referred to is known. Distinguish *alter*, 'one of two,' and *alius*, 'one of several.' Note *unus et alter*, 'one or two.' Note *alii . . alii*, 'some . . others.' Distinquish *nescio quis hoc dixit*, 'someone or other said this,' from *nescio quis hoc dixerit*, 'I do not know who said this.' In the first case *nescio quis* is used as a pronoun pure and simple. In the second, *quis—dixerit* is an indirect question depending on *nescio*. 'Anyone' in a question is *ecquis* when the question is asked for information, *numquis* when the answer 'no' is expected. Distinguish *nostrum* and *vestrum*, which are partitive genitives, as *quisque nostrum*, 'each of us,' from *nostri* and *vestri*, which are objective genitives, as *amor nostri*, 'love of us.' The distinction between *se* and *eum*, *suus* and *eius*, is important. Note the usages of *is*, *hic*, *iste*, and *ille*. Note *idem qui*, 'the same as.' Note that in such sentences as 'his army and that of his brother,' the demonstrative '*that*' must not be translated into Latin, but we will have to say *eius et fratris exercitus*. Note also 'those asking this' is not *ei hoc rogantes*, but *hoc rogantes* or *ei qui hoc rogant*. Distinguish *dicam quod volt*, 'I shall say what he wishes (me to say),' from *dicam quid velit*, 'I shall say what his wishes are.'

Latin Sentences.

(1) All of us were so terrified that we asked the general for peace.

Omnes adeo territi sumus ut imperatorem pacem rogaremus (or *ab imperatore pacem peteremus*.)

Notes.—(*a*) For the way of translating *all of us*, see grammar notes last month and sentence 7 (*c*). (*b*) *So that* is expressed by *ut* and the subjunctive; if negative, *ut non* would be used. (*c*) For the tense of the subjunctive, see March, No. 3 (*c*). (*d*) Most verbs of asking take a double accusative. *Peto* is never followed by two accusatives. To translate 'for peace' by the dative would be utterly wrong.

(2) The barbarians ascertaining the plan of the Romans, prevented the soldiers from marching to the winter camp.

Barbari consilio Romanorum cognito milites quominus ad hiberna (castra) iter facerent prohibuerunt.

Notes.—(*a*) Note that the present participle 'ascertaining' is not translated by the present Latin participle *cognoscentes*, because the pres. part. in Latin is only used when denoting the same time as that of the verb to which it is joined. Now in the sentence above the plan was ascertained *before* the barbarians prevented the enemy. 'Ascertaining' is really = 'having ascertained.' As *cognosco* has no perfect active part., the abl. absolute construction has to be used instead. (*b*) The use of *quominus* after verbs of preventing has been mentioned before. *Ne* could also have been used instead of *quominus*. The imperfect subjunct. *facerent* is due to the rule of the sequence of tenses, as *prohibuerunt* is a secondary tense and requires the tenses of the subjunctive to be either imperfect or pluperfect.

(3) As far as I know, we cannot persuade him to depart from the city of Corinth.

Quod sciam, ei persuadere non possumus ut ex urbe Corintho excedat.

Notes.—(*a*) Note well the phrase *quod sciam*. (*b*) Be careful not to put an acc. after *persuadeo*. (*c*) Remember the rule with regard to the translating of 'to and the infinitive' after verbs denoting ask, command, advise, etc., by *ut* and the subjunctive. (*d*) Note again *urbe Corintho* where *Corintho* is in apposition to *urbe; urbe Corinthi* would be wrong.

(4) Epicurus says that no one, who does not live honourably, can live pleasantly.

Negat Epicurus quemquam, qui honeste non vivat, iucunde posse vivere.

Notes.—(*a*) *Says . . not* is translated in Latin, *not* by *dico . . non*, but by *nego*. Hence 'says that no one' becomes 'denies that anyone.' (*b*) *Anyone* in a negative sentence is translated by *quisquam*, hence *quemquam* here, as the acc. and inf. construction is required after *nego*. (*c*) The subjunctive *vivat* is due to the fact that dependent clauses in reported

speech or *oratio obliqua* are put in the subjunctive. The tense of the subjunctive is determined by the rule of the sequence of tenses.

LATIN TEST PAPER.

(*For regulations, see Correspondence at end.*)

(1) Give the gender and genitive singular and plural of *os, bos, vas, cassis, torques, lapis, aries, pedes, pes, compes, dies, quercus, decor, decus.*

(2) What do you mean by *deponent verbs*? How many participles does an ordinary verb in Latin possess?

(3) What are the constructions of the following verbs: *persuadeo, consulo, laedo, iubeo, impero, noceo, potior, caveo, minor, interest,* and *opus est?*

(4) Explain, with examples, the meaning of *double dative, predicative genitive, ablative of comparison, qualitative ablative, ablative absolute.*

(5) How do you express in Latin (*a*) Point of time; (*b*) Duration of time; (*c*) Time within which an event happens? Illustrate your answer.

(6) How do you express in Latin after a passive verb—(*a*) The agent; (*b*) The instrument? Give examples. Does the poetical usage differ from the prose usage in this respect?

(7) Correct or justify—

(*a*) *Albior est quam nivem* (She is whiter than snow).

(*b*) *Hoc fecisse potuit* (He could have done this).

(*c*) *Non time eum* (Do not fear him).

(*d*) *Imperatus est hoc facere* (He was ordered to do this).

(8) Translate into Latin—

(*a*) We hoped to go to the Senate at Rome before the arrival of the general.

(*b*) No one asked him to support the king at such a crisis as this.

(*c*) All of us resolved to fight with the enemy on the first available opportunity.

(*d*) I can't help saying that he is too good to live.

French Course for June.

(1) Five pages of translation a week, with a certain amount of written translation.

(2) Grammar: Fasnacht §§ 38–56.

Notes on French Course for May.

(The Notes on June Course will be given next month.)

Note the following points:—The use of *ton, mon, son* before a fem. word beginning with a vowel or *h* mute; *leur* is derived from *illorum*, and hence should, according to etymology, remain invariable always, however it takes *s* for the plural, but does not change for the feminine; 'a neighbour of mine,' *un de mes voisins;* Possessive Adjectives are omitted before parts of the body when there is no ambiguity, the singular is also used even when several persons are spoken of, as *ils courbèrent la tête;* uses of *même*; difference between *c'est, il est, ce sont;* uses of *celui* and *tel.*

In the *Relative Pronouns* note well the usages of *qui, lequel, que, dont.* Note the incorrectness of expressions like *dont maison* (whose house) *j'ai vu; l'ami au conseil dont je dois tout* (*dont* cannot depend on a noun governed by a preposition); *le livre j'ai lu,* 'the book I have read' (should be *que j'ai lu*); *le temps quand il fait cela* (should be *le temps où il fait cela*). Learn the declension of the Interrogative Pronouns. Note, *dont parlez-vous?* is bad French; it should be *de qui parlez-vous?* In the Indefinite Pronouns note that *on* with the active voice is often used to avoid the passive. Note that *l'on* is preferable to *on* after *quoi, et, si, que, qui,* and words ending in any vowel except *e* mute. If the word following *on* begins with an *l, on* is used without the *l.* Note in the sentences in Fasnacht the different ways of translating *anyone, someone, nobody, whosoever, whatever, neither, either.* Remember 'others' is *d'autres,* 'the rest' is '*les autres.*' Learn the indefinite words that require *ne* with the verb. *Personne,* masc. = 'nobody'; *personne,* fem. = a person. *Personne n'est supérieure* is therefore incorrect. Distinguish *ailleurs* = 'elsewhere,' and *d'ailleurs* 'besides.'

Greek Course for June.

(1) Iliad 339–421.

(2) In grammar revise λύω, active, passive, and middle, and learn the contracted verbs ending in εω, αω, and οω.

(3) Two pieces of translation at sight a week.

Notes on Greek Course for May.

(Notes on June Course will appear next month.)

1. Iliad 246-338. The following verbal forms should be parsed:—ἵσαν, σπεύσατε, πεφάσθαι, ἐώκειν ἀκώλες, ἐφοπλίσσαιτε, ἐπιθεῖτε, δῆσαν, ζεῦξαν, λείψαντε, μεμαῶτα, ἐρεμένη, ἀπιθήσω, ἐπιχεῖαι, νιφάμενος, εἰσανιδών, ηὔδα, ἦκε, τέτυκται, ἀραρυῖα, εἵσατο, γήθησαν, ἰάνθη, ἐπεβήσετο, ἔλασε, κατέβαν, λάθον, ἐθέλησθα, ἱκέσθαι.

2. In the grammar note that the endings of the primary indicative and the subjunctive tenses in the middle and passive are -μαι, -σαι, -ται, -σθον, -μεθα, -σθε, -νται. Except in the perfect (which is a non-thematic tense), these endings are attached to the stem by what is called a thematic vowel; *e.g.*, ο or ε in indicative, in subjunctive ω or η. In the second singular the σ drops out between the two vowels and contraction ensues; *e.g.*, λυ-ε σαι becomes λύει or λύῃ. The secondary passive or middle endings, or the endings of the secondary tenses of the indicative and of the optative, except in the weak and strong aorist passive, are -μην, -σο, -το, -σθον, -σθην, -μεθα, -σθε, -ντο. In the secondary tenses, except the pluperf., which is non-thematic, these endings are joined to the stem by a thematic vowel. This vowel is in the imperf. and strong aorist middle indicative ο or ε, in the first aorist indicative α, in the optative οι or αι. In the second singular σ disappears between the two vowels; *e.g.*, ἐλύσ-ασο = ἐλύσ αο = ἐλύσω; ἐλύ-ε-σο = ἐ λύεο = ἐλύου; λυ οι σο = λύοιο. The weak and strong passive aorists have not the ordinary secondary endings. The passive aorist subjunctive has the active endings. All the middle and passive participles end in -μενος, except the weak and strong aorist passives, which end in -εἰς. This μενος, in the pres., fut., and strong aorist middle, has the thematic vowel ο, in the weak aorist middle the thematic vowel α, and in the perf. is added to the perfect stem without a connecting vowel. The perfect participle middle or passive has always an acute accent on the ε. With regard to the infinitives, the ending is -σθαι, except in the weak and strong aorist passives. This -σθαι, in the present, fut., and strong middle aorist, is connected with the stem by the thematic vowel ε, in the weak aorist middle is connected by the vowel α, and in the perfect there is no thematic vowel.

English Course for June.

(1) Hewitt and Beach pp. 176–195; 317–350: or Morris's Outlines on the Defective and Auxiliary Verbs, with Beach's Elements pp. 60–63; pp. 109-118.

(2) History from the end of the reign of Henry III. to the end of the reign of Richard II. Revise from the beginning to the reign of Alfred.

Notes on English Course for May.

(Notes on June Course next month).

History.—The following points should be especially noted: The bartering of the sovereignty of Scotland by Richard I.; the Crusades, with special reference to the part which Richard I. played in them; *Carucage,* or name under which *Danegelt* was revived in Richard's reign; importance of the loss of Normandy in John's reign, from which Macaulay dates the beginning of English History; John's quarrel with the Pope; Stephen Langton and Robert Fitz Walter; the opposition of the barons; the Battle of Bovines, leading to the Magna Charta with its important provisions; the Battle of *Damme;* John's character, various opinions of his ability, 'a trifler and a coward' (Macaulay), the ablest and most ruthless of the Angevin Kings (Green); Regency of Pembroke; Fair of Lincoln; Hubert De Burgh and Peter Des Roches, their policy; causes of discontent with Henry's government; the causes, progress, and results of the Barons' War; Simon De Montfort's policy and career; the Mad Parliament; Provisions of Oxford; the first House of Commons, reasons why it was not really representative; Mise of Lewes; Mise of Amiens; Battles of Lewes and Evesham; Dictum of Kenilworth; Charter of Forests; introduction of the Mendicant Orders; commencement of the system of popular representation.

Grammar.—Learn the definition and classification of verbs. Be able to define Transitive and Intransitive Verbs, Strong and Weak Verbs, Auxiliary and Principal Verbs. Note how Intransitive Verbs are made Transitive. Define

Voice, Mood, and Tense. Learn a classification of the Tenses. Learn the principal uses of the Moods. Discuss the origin of 'to' with the infinitive. Trace the history of the Participles and Verbal Nouns, and distinguish their usage in modern English. Be able to comment on such phrases as 'I am a doing of it,' 'the eating heavy suppers is dangerous,' 'I insist on you doing this,' 'a well read man,' 'a walking-stick,' 'church-going people.' Learn the inflections which verbs admit. Define Conjugation. Note that Strong Verbs are older than Weak Verbs, and be able to give reasons. Be able to discuss the terms Regular and Irregular Verbs. Learn a classification of Strong Verbs. Note the only two remnants of reduplication in English. Note *yclept, star-y-pointing* (Milton). Learn the results of the decay of Verbal Inflections. Be able to define Impersonal or Uni-Personal Verbs, with an account of their usages, noting sentences like 'Methought I by the brook of Cherith stood.'

MATHEMATICS.

Arithmetic Course for June.

The study of the decimal system of notation will provide a good month's reading for those who are not already thoroughly familiar with it. The chapters on 'Decimal Fractions' and 'Recurring Decimals' in Lock's Arithmetic contain the necessary bookwork, and also plenty of examples, from which the student can make a selection.

Read carefully the proof of the rule for converting a recurring decimal into a vulgar fraction, so as to become independent of the rule, *e.g.*,

To express $\cdot 04\dot{3}$ as a vulgar fraction,

1,000 times $\cdot 04\dot{3} = 43\cdot 4343$;

10 times $\cdot 04\dot{3} = \cdot 4343$.

Hence by subtraction :

990 times $\cdot 04\dot{3} = 43$;

or $\cdot 04\dot{3} = \frac{43}{990}$.

Note and be able to prove that a vulgar fraction (in its lowest terms), whose denominator is $n + 1$ must, when converted into a decimal, either terminate or recur at or before the n^{th} decimal figure. Thus $\frac{1}{7}$, or $\cdot 142857$, does not recur until the 6th figure, a decimal of the maximum number of figures for a fraction with a denominator 7.

Algebra Course for June.

The student may this month further practise himself in the solution of quadratic equations.

We give below the solution of a typical example :—

Solve $3x^2 - 7x + 4 = 0$.

(1.) Keep the x's on one side, and numbers the other.

$$3x^2 - 7x = -4.$$

(2.) Divide by coefficient of x^2,

$$x^2 - \tfrac{7}{3}x = -\tfrac{4}{3}.$$

(3.) Add to each side the square of half the coefficient of x.

$$x^2 - \tfrac{7}{3}x + (\tfrac{7}{6})^2 = -\tfrac{4}{3} + \tfrac{49}{36} = \tfrac{1}{36}.$$

(4.) Take the square root of both sides :

$$x - \tfrac{7}{6} = \pm \tfrac{1}{6}.$$

(5.) $$\therefore x = \tfrac{7}{6} + \tfrac{1}{6}, \text{ or } \tfrac{7}{6} - \tfrac{1}{6}$$
$$= \tfrac{4}{3}, \text{ or } 1.$$

Note that a simple or first degree equation has only 1 root, a quadratic 2 roots, due to the $\pm$ sign of the square root ($\frac{1}{6}$ in above example).

We may remark, while discussing the subject of quadratic equations, that if the roots of $ax^2 + bx + c = 0$ be α and β, then the factors of $ax^2 + bx + c$ are $a(x - \alpha)(x - \beta)$; for example, $x^2 - 7x + 12$ when solved gives 3 or 4 for its roots, so that $(x - 3)(x - 4)$ are factors of $x^2 - 7x + 12$. So likewise the factors of $3x^2 - 7x + 4$ (solved above) are

$$3(x - \tfrac{4}{3})(x - 1) = 3\cdot\left(\frac{3x - 4}{3}\right)(x - 1) = (3x - 4)(x - 1).$$

The student should also be able to prove that if α and β are roots of $ax^2 + bx + c = 0$, then $\alpha + \beta = -\frac{b}{a}$, and $\alpha\beta = \frac{c}{a}$; a proof of this is to be found in any good text-book.

There are several types of equations which can be solved by similar methods to quadratics, *e.g.* :

(1.) $$x^2 - 3x + \frac{1}{x^2 - 3x} = 10\tfrac{1}{10}.$$

This, if $x^2 - 3x$ be put equal to y, becomes

$$y + \frac{1}{y} = 10\tfrac{1}{10} ;$$

or $$10y^2 - 101y + 10 = 0,$$

giving $$y = 10, \text{ or } \tfrac{1}{10}.$$

To solve the original equation, we then have :

$$x^2 - 3x = 10 ; \text{ or } x^2 - 3x = \tfrac{1}{10},$$

giving $$x = 5, \text{ or } -2 ; \text{ or } x = \frac{15 \pm \sqrt{235}}{10}.$$

(2.) $$x^4 - 8x^2 + 12 = 0,$$

which is a quadratic in x^2 ;

giving $$x^2 = 6, \text{ or } 2 ;$$
$$\therefore x = \pm\sqrt{6} ; \text{ or } \pm\sqrt{2}$$

four answers, the original equation being of the fourth degree in x.

(3.) $x^3 + 1 = 0$, which is equivalent to

$$(x + 1)(x^2 - x + 1) = 0 ;$$

giving the 2 equations $x + 1 = 0$, *i.e.*, $x = -1$; or

$$x^2 - x + 1 = 0 ;$$

a quadratic giving two more answers.

Euclid Course for June.

Read Euclid III. 10–25, and work the following riders :

(1.) State and prove the converse of III. 22.

(2.) Show that the two tangents drawn to a circle from an external point are equal.

(3.) ABCD is a quadrilateral in which a circle can be inscribed ; prove that the sum of AB and CD is equal to that of BC and AD.

Hints on the May riders :

(1.) Let A and B be the 2 given points. Bisect AB at right angles by CD, cutting the given straight line at C. C is then centre, and CA radius of required circle.

(2) is III. 25.

(3.) Taking the figure of I. 47, as given by Hall and Stevens in their edition of the 'Elements,' the proof will stand as follows :—

Let AL cut BC in R.

Then sq. on AB = fig. AF = fig. BL.

∴ sqq. on AB and BC together = figures BL and BE.

Also sq. on AC = fig. AK = fig. RE.

∴ sqq. on AB and BC are together greater than sq. on AC by twice the fig. BL, *i.e.*, twice rect. CB.BR.

(3) was set last January Matriculation.

MECHANICS.

Course for June.

The motion resulting from 2 unequal masses connected by a light string passing over a smooth pulley should be carefully studied, and the method of finding the tension of the string. A description of Atwood's machine, and the experiments performed with it, should be read. The subject of 'the conservation of energy' should be mastered ; note that the change of kinetic energy, divided by the space through which the mass has moved under the action of a constant force, gives the magnitude of the latter in poundals. Distinguish between foot-pounds and foot-poundals. This part of the subject is excellently treated in Loney's Mechanics [Pitt Press].

CHEMISTRY.

Course for June.

This month may be devoted to a study of the chemical constitution of water. The student should be quite clear as to how it is ascertained that water consists of H and O in the ratio 1 : 8 by weight ; the method of proving this by passing H over red-hot oxide of copper should be carefully studied. The various means of softening hard waters should be read. The preparation and properties of nitrogen may also be read up, and also ammonia. Note the reasons for stating the air to be a mechanical mixture, and not a chemical compound of N and O.

Mathematical Test Paper.

(1.) Find the lowest number which, when divided by 2, 3, 4, 5, 6, 7, 8, and 9, gives remainders 1, 2, 3, 4, 5 6, 7, and 8, respectively.

(2.) Two clocks, A and B, which gain respectively 3 and 5 minutes an hour, are together at 1 p.m. on Wednesday, March 14; when will they next both show (1) same time, (2) same correct time?

What time will B indicate on the following day when A is at 1 p.m.

(3.) Establish the truth of the following identity:

$$(x - 3a)^3 + (2x + 5a)^3 - (3x + 2a)^3 = -3(x - 3a)(2x + 5a)(3x + 2a).$$

(4.) Factorise:

(1) $x^4 + 64y^4$.

(2) $3x^2 - 2y^2 + 5xy + 2x - 3y - 1$.

(5.) A stone is projected up from the top of a tower 240 feet high at a rate of 40 feet per second, and at the same instant one is projected up from the foot of the tower with a velocity of 100 feet a second. When and where will they meet?

(6.) One train is passing through a station at the uniform rate of 60 miles an hour, another train is just starting from the station in the opposite direction, with an acceleration of 4 feet per second. Supposing each train to be 100 yards long, how many seconds will they be in passing?

Correspondence.

Teachers wishing to have their test papers corrected should send the same addressed to the 'Matriculation Editors,' care of Joseph Hughes and Co., Froebel House, St. Andrew's Hill, Doctors' Commons, London, E.C., and enclose a remittance of 6d. for each paper.

Next month there will be test papers in Latin, French, Mechanics and Mathematics.

The Matriculation Editors will be pleased to reply briefly through these columns to those seeking advice.

SOLUTIONS TO THE PAPER IN ELEMENTARY PHYSIOGRAPHY, 1894.

SERIES I.

1. (*a*) Name the chemical elements which are present in carbonate of lime (calcic carbonate).

(*b*) State the nature of each of these elements.

(*c*) How can carbonate of lime be broken up into two oxides? What are these oxides called?

(*d*) Name three common rocks which are composed of carbonate of lime.

1. (*a*) The three elements which are combined in the chemical compound, carbonate of lime, are Calcium, Carbon, and Oxygen.

(*b*) Calcium is a solid under ordinary conditions of temperature, and is a yellow lustrous metal when isolated. Chemically it is a dyad. It does not occur native.

Carbon is a non-metallic solid tetrad, and is found native in three allotropic forms, as the diamond, as graphite, and as charcoal.

Oxygen, when uncombined, is one of the so-called 'permanent' gases, *i.e.* it remains a gas except under conditions of extreme cold and pressure. It is a dyad and a non metal.

(*c*) Carbonate of lime can be decomposed by heating, into the two oxides, calcium monoxide or lime, CaO, and carbon dioxide, CO_2. Thus in the common process of preparing lime, carbonate of lime is thrown into kilns and roasted, the gaseous carbon dioxide escaping, and the solid lime being raked out at the bottom of the kiln.

This same dissociation may be effected in the laboratory on a small scale by heating the carbonate of lime in a retort; the CO_2 given off may be collected over water, while the white mass of CaO remaining will exhibit the distinctive properties of quick lime.

(*d*) Any three of the following may be correctly given:—

(1) Crystallized limestone or marble.
(2) Shell limestone.
(3) Oolite.
(4) Chalk.
(5) Crinoidal limestone.
(6) Coral limestone.
(7) Travertine (Calcareous Tufa or Calc Sinter.)
(8) Marl.

[N.B.—7 and 8 are the least typical. 7 is uncommon, 8 very impure.]

2. (*a*) How can it be proved that the air has weight?

(*b*) In what proportions and in what condition are oxygen and nitrogen present in air?

(*c*) Describe experiments by which oxygen can be taken out of air and collected in a separate vessel.

(*d*) Describe an experiment by which nitrogen may be separated from the oxygen in the air.

2. (*a*) A common experiment is to weigh a stoppered flask first full of air, and then again after it has been exhausted under an air-pump, a diminution of weight being observed in the second case. Or a tube or beaker being filled with water and inverted over a trough of water the water will not flow out, the pressure of the air on the water surface outside sufficing to support it in the beaker. This pressure can only be due to the weight of the superincumbent atmosphere.

(*b*) Oxygen forms nearly one-fifth and nitrogen four-fifths of the volume of the air, or, more exactly, in 100 volumes of air 20·8 are oxygen, 79·2 are nitrogen. By weight the proportions are oxygen 23, nitrogen 77, in 100 parts of air. They are both 'permanent' gases, and exist in the air in a state of *mixture*, that is, they are present as free elements, and are not in chemical combination.

(*c*) The general principle underlying all such experiments must be first the oxidation, and then the reduction of some convenient substance. Thus, by heating mercury in air it will combine with the oxygen of the air to form mercuric oxide, HgO. By heating this again to a red heat it will be decomposed into mercury and oxygen, and the oxygen evolved may be collected over the pneumatic trough.

In the same way, by heating lead oxide, PbO, in air it is oxidised to Pb_3O_4. When this is raised to a red heat, it decomposes again into PbO and oxygen, which may be collected in the ordinary manner.

Another method (of no practical value) of obtaining oxygen from the air would be to explode hydrogen in air, when it would combine with oxygen to form water; by electrolysis of this water the oxygen could be again recovered in the free state.

(*d*) By igniting phosphorus under a bell-jar placed over water, it will combine with the oxygen in the air to form phosphoric pent-oxide. The white fumes of this being soluble in water, and having a great affinity for it, will be dissolved, and only nitrogen will be left in the bell-jar.

3. Describe:—(*a*) Cloud, (*b*) Rain, (*c*) Hail, (*d*) Snow, and state the mode of formation of each.

3. (*a*) *Cloud* consists of a quantity of small particles of water suspended in the air at some distance from the earth's surface. It is formed by the cooling of the air in the space in which it appears, below the dew-point, and the consequent condensation of minute droplets of air. Some clouds, especially the cirrus clouds and snowstorm clouds, presumably consist not of droplets of water but of snow particles, where the dew-point was below the freezing-point.

(*b*) *Rain* consists of drops of water falling upon the surface of the earth, and is usually the result of the continuation of the process of cloud formation, the small droplets of the cloud coalescing into larger ones, which present less surface resistance to the air in proportion to the weight. For rain to reach the earth, all the air between the cloud and the surface must be saturated, and above the freezing-point.

(*c*) *Hail* consists of small masses of ice falling on the surface of the earth and having a concentric structure. It results from the freezing of water after it has been condensed to drops of liquid, and the subsequent addition of fresh layers of ice.

(*d*) *Snow* consists of flakes of frozen water falling upon the earth's surface, these flakes being not compact masses of ice but skeleton crystals, which have been formed by the immediate precipitation of water in a solid form. The air, and of course its dew-point, must be below zero Centigrade.

4. State the composition of the materials ejected from:—(*a*) Fumaroles, (*b*) Geysers, (*c*) Mud-volcanoes, (*d*) Ordinary volcanoes.

4. (*a*) *Fumaroles* are apertures in the earth's crust in volcanic regions, whence vapours and gases are emitted. Among these are vapour of water, hydrochloric acid, sulphuretted hydrogen, sulphur dioxide, carbon dioxide, hydrogen, and nitrogen.

(*b*) *Geysers* are essentially volcanoes, but differ in that they erupt only hot water and steam, with various kinds of mineral matter dissolved therein, but practically without any accompaniment of fused or powdered mineral matter. Among these dissolved substances are silica, carbonate of lime, soda, potash, etc.

(*c*) *Mud-volcanoes* are volcanoes ejecting a mixture of finely divided particles, *i.e.* volcanic ash, and water and gas. This mixture is formed from the escape of steam, which is the essence of

all volcanic activity taking place through rocks of a clayey nature. This forms a mud, which builds up a low cone-shaped mass round the aperture of emission.

(*d*) *Ordinary volcanoes* eject—

(1) Vapours and gases, among which are steam (in enormous quantities), hydrochloric acid, carbon dioxide, sulphuretted hydrogen, sulphur dioxide, hydrogen, and nitrogen.

(2) Molten rock, flowing out in stream and generally known as *lava*. Lava has many forms, ranging from an entirely crystalline structure to a vitreous or glassy and almost amorphous state. Many have the appearance of furnace slags. Usually a lava contains a greater or lesser number of cavities due to the steam in its substance, and *pumice* is lava in which the escape of this steam has produced such a vast quantity of hollow vesicles as to give it the appearance of a 'rock-froth.'

(3) Masses of rock of various sizes which are thrown out of the crater. They are known by several names, used to denote differences of size and structure. Such are *Scoriae*, a term used to denote masses of a rough slaggy appearance which are hurled out high into the air; *lapillae*, similar, but smaller fragments; *volcanic ash*, a fine powder ejected in violent eruptions when the strain on the masses of rock is so great that they are blown to powder.

Volcanic bombs are hollow elliptical masses of lava, and clots of lava are splashed out of a volcano which harden with filamented ends, and are known as *Pelé's Hair*.

SERIES II.

5. How is the position of a heavenly body defined—
(*a*) In relation to the plane of the equator;
(*b*) In relation to the plane of the ecliptic?

(*a*) By Right Ascension and Declination.
(*b*) By 'Celestial' Longitude and Latitude.
(The question is completely answered by the two lines above, but, in order that the examiner may be assured that the candidate knows the exact meaning of the words used, rough definitions such as the following should be given:—)

Right Ascension is angular distance from the 'first point of Aries,' measured eastward along the celestial equator.

Declination is angular distance north or south of the celestial equator.

Celestial Longitude is angular distance from the 'first point of Aries,' measured along the ecliptic.

Celestial Latitude is angular distance north or south of the ecliptic.

6. State what you know of the equation of time:—
(*a*) In relation to its amount at different times of the year.
(*b*) In relation to its use in determining the moment of mean noon.

(*a*) The varying amount of the equation of time, or, what amounts to the same thing, the difference in the lengths of the solar days throughout the year, is due to (1) the eccentricity of the earth's orbit, on account of which the earth moves with varying speed; (2) the obliquity of the ecliptic. The total result of the action of these two causes is that there is no equation of time on April 15, June 14, September 1, and December 24, that is to say, on these dates mean time and apparent or true solar time agree. On February 11, apparent time is behind mean time by the maximum amount (14½ mins.), and on November 2, apparent time is ahead of mean time by the maximum amount (16¼ mins.).

(*b*) As the equation of time is the amount to be added to or subtracted from true solar time to convert it to mean time, the moment of mean noon on any day of the year can be found by applying the equation of time to apparent noon. When the equation is *plus*, the true sun passes the meridian after mean noon, and when *minus*, it passes the meridian before mean noon.

7. State the apparent daily movements at London of stars situated near North Declination 90°, 51°, 39°, on the Equator, and near South Declination 20° and 38°.

A star in North Declination 90°, that is, at the north celestial pole, would appear to be stationary whenever visible. Stars near it would appear to describe small circles around it.

A star in North Declination 51° would appear to describe a circle, having a radius of 39° around the north celestial pole, and at the highest point of its path would be exactly overhead.

A star in North Declination 39° would appear to describe a circle with a radius of 51° from the north celestial pole, and at the lowest point of its path would just touch the northern horizon.

A star on the celestial Equator would appear to describe a semi-circle, and would rise due east and set due west.

A star near South Declination 20° would rise to the south of east and set to the south of west, its apparent path being an arc of a circle.

A star near South Declination 38° would be just above the southern horizon at the highest point of its path.

8. How has the shape of the earth's orbit been determined?

By measuring the sun's angular diameter throughout the year. It is found that the diameter on January 1 is 32½′, and on June 30 31½′, while on April 4 and September 29 the value obtained is 32′. These measures show that the earth's path is not a circle, for then the sun's apparent diameter would always be the same. Trigonometry enables the sun's distance in miles to be calculated from the real and angular diameters. If lines radiating from a common centre are drawn to represent the distances calculated at various times of the year, they will be found to vary in length, and the line connecting their ends will be an ellipse.

We hope to give answers to the Advanced and Honours Stages of Physiography in our July number.

LEGAL AND CODE QUERIES COLUMN.

RULES.

1. All communications must be addressed 'Legal Editor, PRACTICAL TEACHER, Froebel House, St. Andrew's Hill, Doctors' Commons, E.C.,' and must be accompanied by our 'coupon,' duly filled up.
2. Replies will be given *only* in this column, except under the conditions named in Rule 3.
3. If any reader desires a reply by post, such can be forwarded by enclosing, in addition to the coupon, a stamped addressed envelope and either stamps or a Postal Order to the value of one shilling.
4. No original documents should be forwarded, but copies only. We cannot hold ourselves responsible for any losses which occur through non-observance of this rule.

'MARRIAGE.'—There are four different modes of procedure, one of which must be adopted precedent to the final ceremony, which produces the false mathematical result—(1 + 1) = 1. These are: (1) *Common Licence.* This can be obtained from the office of the Bishop of the Diocese, or the representative of his lordship, who is technically termed the surrogate. One of the parties must have resided in the parish in which the ceremony is to be performed for at least 15 days. The fees vary between £2 2s. and £3 3s. The licence fixes the time and place. (2) *Special Licence.* Very rarely issued, and can only be obtained at the Faculty Office, Doctors' Commons. This licence empowers the parties to be married at *any time* in *any place.* The fees are about £30. (3) *Banns.* These must be published in the church of the parish in which both parties, or each of them, reside for 3 consecutive Sundays. (4) *Marriage before a Registrar.* These marriages are performed either at the office of the superintendent registrar, or in any place of worship other than one of those in connection with the Church of England. Notice must be given to the registrar by one of the parties, who must, at the time of giving notice, have resided in the district for seven days. Twenty-one days after the giving of notice the ceremony may be performed. 10s. covers the fees to the registrar.

'M.R.'—You ask me to define a Public Elementary School. It is difficult to *define*, but the following description is the best I know. A public elementary school is one (1) to which the attendance at any place of worship is no condition of admission; (2) at which religious instruction is separate and optional; (3) which is subject to Government inspection in secular subjects; and (4) which is so conducted as to receive an annual parliamentary grant. The conditions which have to be fulfilled in order to comply with 'No. 4' are laid down in the Education Code of each year.

'Parish Councils.'—The Act establishing Parish Councils, does not affect educational matters except in one particular. This is in connection with the use of school-rooms for public purposes. It is provided in this Act that:—

1. In any rural parish in which there is no suitable public room vested in the parish council or in the chairman of a parish meeting and the overseers which can be used free of charge for the purposes in this section mentioned, the parochial electors and the parish council shall be entitled to use, free of charge, at all reasonable times, and after reasonable notice, for the purpose of:—

(*a*) the parish meeting or any meeting of the parish council; or

(*b*) any inquiry for parochial purposes by the Local Government Board or any other Government department or local authority; or

(*c*) holding meetings convened by the chairman of the parish meeting or by the parish council, or if as to allotments in the manner prescribed by the Allotments Act, 1890, or otherwise as the Local Government Board may by rule prescribe, to discuss any question relating to allotments, under the Allotments Acts, 1887 and 1890, or under this Act; or

(*d*) the candidature of any person for the district council or the parish council; or

(*e*) any committee or officer appointed, either by the parish meeting or council, or by a county or district council, to administer public funds within or for the purposes of the parish

any suitable room in the schoolhouse of any public elementary school receiving a grant out of moneys provided by Parliament, and any suitable room the expenses of maintaining which is payable out of any local rate.

Provided that this enactment shall not authorise the use of any room used as part of a private dwelling-house, nor authorise any interference with the school hours of an elementary day or evening school, nor, in the case of a room used for the administration of justice or police, with the hours during which it is used for these purposes.

'L.M.'—The following decision of the Education Department supplies an answer to your query:—

'My Lords are of opinion that the sending home of a child who presents himself for admission to the school, on the ground that the teacher wishes to confer with the parents as to the child's irregular attendance, and making the child's admission conditional on the parents' attendance, is equivalent to a refusal to admit the child, and they are further of opinion that the grounds for such refusal to admit are not reasonable under Article 78 of the Code. The proper course will be for the child to be admitted, and for the teacher, if he desires to speak to the parent, to send a message to that effect by the child after school, or to communicate in some other way with the parent. The child should continue to be admitted to the school, whether the parent is willing to see the teacher or not.'

'C.P.H.'—The only remedy available is for the managers to summon the parent for trespass, but it is not a course which I can recommend, unless the man again offend. The usual procedure in such cases is for the correspondent to the managers to write to the parent, and inform him that he has no right to enter upon the school premises without their consent, and that they withhold such consent. It is a common error to suppose that parents of scholars attending a school have an inherent right to enter upon the school premises. A member of the general public, parent or not, has no more right upon the school premises, Board or Voluntary, than he has upon premises of a purely private character.

'C.G.B.'—Yes.

'R.T.'—Yes, a *criminal* information for libel may be filed, but it is a mode of procedure which is rarely resorted to, and ought only to be adopted after very careful consideration by and on the advice of counsel.

'George.'—A schoolmaster is not exempt by virtue of his office from serving upon a jury.

'G.T.'—It would occupy half a column to answer your question fully. The new Syllabus for the Scholarship Examinations, which can be obtained, post free, on application to 'The Secretary, Education Department, Whitehall, S.W.,' supplies all the information you require.

'School Accommodation.'—The Education Department hold that 'the number of vacant places in a school is measured by the excess of the number of children for whom accommodation is provided over the number on the books (not the number in average attendance). The extract is from an official letter sent to the Stockport School Attendance Committee.

'R.A.'—Yes; you can sit in December, 1895.

'G.M.'—It depends entirely on the covenants in your lease. If it is drawn in the usual fashion, you are liable. I shall be glad to advise you definitely, if you care to take the trouble of sending me an exact copy.

'Art. 73.'—You will find an authoritative interpretation of the Article in the chapter on 'Changes and Warnings,' in the new edition of Yoxall and Organ's Code for 1894–5.

'C.S.H.'—He cannot be recognised as an assistant until after the result of the examination is announced.

'Science.'—It is not correct to state that graduates of a university of the United Kingdom are recognised as qualified to earn grants on the results of instruction given in *any* subject named in Science and Art Directory. Such a regulation used to obtain, but it has now been restricted to 'Graduates of any university of the United Kingdom *whose degrees cover the subject they propose to teach*.'

'Anxious.'—Yes, it is only too true that the Education Department recognise schools which are under the management of one person. Pity it is, that teachers can be found who accept posts in such schools.

'Cookery.'—The Department have issued a list of Training Schools of Cookery whose certificates are recognised by them under Art. 101 (g) of the Code. You will find the list in any Annotated Edition of the Code. It appears on page 245 of the 'N.U.T.' edition.

'F.C.S.'—These letters signify that the man to whose name they are attached is a Fellow of the Chemical Society. I do not know the conditions under which the fellowship is granted, but the Secretary of the Society will no doubt supply you with the information. His address is, Burlington House, London, S.W.

'MANUAL INSTRUCTION.'—The particulars are too long to give in this column, but you will find them in 'Form 813' and 'Circular 44,' which can be obtained from the Science and Art Department.

T.W.—*Children under* 3.—The attendances of these children must be separately registered so as to be taken into account in calculating accommodation, and also in determining the teaching staff required; but they are not taken into account in calculating the grant.

'T.R.'—Sidesmen are now practically assistant churchwardens. The term is a corruption of 'Synods-men,' who were persons appointed in large parishes to assist the churchwardens in enquiries into the character and conduct of parishioners, and, if deemed necessary, to present offenders at visitations.

FLOTSAM AND JETSAM.—Both of these words are technical legal terms. *Flotsam* connotes goods floating upon the sea, which belong to the Crown unless claimed by the true owners within a year and a day. *Jetsam* connotes goods or other things which after having been cast overboard in a storm, or after shipwreck, are thrown upon shore.

R.L.S.—Unless you can clearly prove the contrary intention to have existed in both your minds at the time of taking, the tenancy is a yearly one, and can only be terminated by a three months' notice to quit, ending on an anniversary of the day of taking.

'DUPED.'—You can remove the bushes, but not the trees. If you remove or seriously injure the trees you will be liable to an action to recover damages.

'CLERK IN HOLY ORDERS.'—Stephen, in his 'Commentaries on the Laws of England,' gives the origin of this term. He states, referring to the period just after the Norman Conquest, 'The clergy, in particular, as they were then engrossed in almost every other branch of learning, so (like their predecessors, the Druids) were peculiarly remarkable for their proficiency in the study of law. *Nullus clericus nisi causidicus* is the character given of them soon after the Conquest, by William of Malmsbury. The judges therefore were usually created out of the sacred order, as was likewise the case among the Normans; and all the inferior offices were supplied by the lower clergy, which occasioned their successors to be denominated *clerks*, as they are to this day.'

COMING MEN.

IX.—MR. W. H. TOTTERDILL,

Hon. Sec. to the National Federation of Assistant Teachers; President of the Sheffield Assistant Teachers' Association.

THE editorial dictum reached us that Mr. W. H. Totterdill was the next of to-day's 'Coming Men' who was to be sketched in these columns, and forthwith we proceeded to the smoky, busy town of Sheffield. Our journey thither carried us through the heart of the busy hive of industry that ceaselessly throbs in West Yorkshire, through country scenes blurred and blackened by the smoke from factories and collieries, until we reached the town which has been aptly described as 'a dirty picture with a beautiful frame.' And the simile is by no means inappropriate, as the town of cutlery, uninviting as it first appears, is endowed with picturesque surroundings. Our destination was 81, Douglas Road, and here we found a cordial welcome from the subject of our sketch and his partner in comfortable bachelor quarters, who is no other than our respected and familiar friend, Mr. William Sinclair. Our first impressions were received from the abundant evidence that Union matters do not suffer from lack of interest and energy at Douglas Road.

W. H. Totterdill

If ever two ardent and earnest workers for the cause of education and the educator existed, we were privileged at that moment to be with them.

Coming to the object of our visit, we elicited that Mr. Totterdill commenced his career in the town of Bristol in 1869. Bristol has much reason to be proud of the many individuals it has produced who have come to the front in the educational world.

Mr. Totterdill received his early education at the St. George's National School and at Queen Elizabeth's Hospital. He became a pupil teacher at the Newfoundland Road Board School, and from thence he proceeded to the Borough Road Training College, where he spent the two years of 1889–90. Leaving college, he entered the service of the Sheffield School Board and became assistant master at the Langsett Road Board School, where he is at present engaged.

He joined the N.U.T. immediately on leaving college, and his ability soon brought him into promi-

nence in the large and influential association at Sheffield. In 1892 he was elected to the Committee of this organisation, and at once began to display that grasp of educational questions which has brought him so rapidly before the notice of his professional colleagues. In the following year he organised a scheme, with commendable success, for taking the children of parents who could not afford the expense of accomplishing the necessity themselves, out into the country for a week's holiday. By the aid of voluntary subscriptions and public support he was enabled to provide for two hundred of the poor little ones of Sheffield a treat which they had never before realised. That Mr. Totterdill is a valuable member of the Benevolent Committee of the Sheffield Association goes without saying. He holds a position on the Organisation Committee also, a post wherein his abilities are of great service. It is of course obvious that, in a large and progressive organisation like the Sheffield Branch of the N.U.T., only the most capable individuals can come to the fore, and it is a striking testimony to Mr. Totterdill's unionism that he has already represented his association at two conferences, viz., Liverpool and Oxford. We were not long in discovering that he belongs to the party of progress. Although possessed of what might by many be called 'extreme' views, he is no pessimist. Speaking of the position of the teacher and the consequent proper policy of the N.U.T., he said:—

'I believe that the teacher's position cries for the urgent attention of the Union in the direction of taking active steps to ameliorate his condition. The scandalous salaries paid to many should be dealt with. It is essential that the Union should establish a standard rate of wages, though I can see that at the present time a pure trades union policy is fraught with some amount of danger. Public opinion, though, would, I feel sure, support our action. I am strongly in favour of the proposal to establish a Sustentation Fund for the maintenance of such of our brethren as refuse to work for an inadequate salary. It is necessary, however, to educate a large proportion of the members of the Union. Probably the best means to adopt is for the Executive to formulate a complete scheme and place it before the Associations.'

Mr. Totterdill waxed eloquent on the remuneration doled out to the primary teacher, in spite of his acknowledged superior training for his vocation.

'What,' we asked, 'is your opinion of the present system of training teachers?'

'It is,' he said, 'a system that requires completely overhauling. The chief difficulty lies in the training of pupil teachers. Many promising teachers are ruined because of the lack of efficient means for their tuition. Pupil teacher centres should be established in rural districts, and practical training should be insisted upon during their apprenticeship. The scholar does not necessarily make the teacher. I believe in compulsory training, and every Queen's scholar should have the opportunity of entering college. Religious tests should be abolished. The curricula for obtaining the Teacher's Diploma should be of such a nature as to render every qualified teacher capable of *teaching* the required subjects. The grinding which exists today for the purpose of obtaining additional certificates is deplorable, as it narrows the teacher's mind, and to a large extent prevents him becoming a useful member of society.'

In reply to a question upon the matter of Rate Aid to Voluntary Schools, Mr. Totterdill ventured the following:—

'Without committing myself to any opinion upon the matter itself, I feel that it is not a question for our Union to take up, as it is really a subject for managers. The dealing with it would be certain to ally the N.U.T. with a political party, and it should not therefore be dealt with by a non-political organisation.'

A further query elicited the fact that Mr. Totterdill was conscious that a grave and important duty lay before the N.U.T. in closely watching the interests of the primary school teacher in the event of legislation being enacted with respect to the organisation of Technical and Secondary Education.

Coming now to the question with which Mr. Totterdill is most closely allied, the cause of the Assistant Teacher, we found that he was in 1893 elected Vice-President of the Sheffield Assistant Teachers' Association, which is the largest organisation of its kind in the country. He is at the present time President of that body. His actions on behalf of the assistant teachers have been mainly directed in attempts to remove the restrictions under which they labour.

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He is of opinion that the assistant teachers have undertaken in a great many cases to keep impossible regulations, and hence they are morally bound to strive for their removal. The agitation on the subjects of Salaries and Corporal Punishment that has taken place in Sheffield has had the effect of demonstrating the energy of the local assistants' President. He represented the Sheffield assistants at the Nottingham Conference of Assistant Teachers, and contributed a valuable item in the discussion on the Federation question. Again at Derby did he voice the opinions of his colleagues, and here it was that he was elected Secretary to the National Federation.

Of his ability in that position we could say much. It will suffice if we add that he has won the admiration of his co-workers by the brilliant manner in which he has organised what augurs to be a most powerful adjunct to the N.U.T. To those who propound the preposterous theory that the Assistant Teachers' Federation is an organisation antagonistic to the greater Union, this inadequate sketch of the Federation's Secretary should provide sufficient reason for recantation.

Mr. Totterdill resented the action of the Executive of the N.U.T. in attempting to divide the local associations into sections, and was instrumental at the Oxford Conference in preventing such action being endorsed.

Outside his profession he is known as one who has entered the field in the struggle for greater social equality.

'The teacher,' he says, 'can be of incalculable service if he will help to solve the great social problems of the day. His education, his connection with the masses, his knowledge of social conditions, combine to make it his duty to aid in any legitimate attempts to bring about a better state of circumstances for the greater community of the people.'

Many incidents during our stay in Sheffield convinced us that the teachers there have a great respect for the man whose career we have depicted. Though but a young warrior in the arena of public and professional politics, Mr. Totterdill is of that mould which inevitably leaves its impression deeply marked on the tablet of time, and it is well that the Teachers' Union can claim such, and fitting at the present juncture that the younger members of the profession should have among them such as he, who, with determination and politic skill, may strive for their betterment.

QUERY COLUMN.

BEGINNER.—Find the value or values of θ, less than 180°, which satisfy the equations—

(a) $13 \sin\theta = 3$.

(b) $5 \tan\theta + 2 = 0$.

(*Science and Art Examinations.*)

BRITISH 28 MY 94 MUSEUM

(a) $13 \sin\theta = 3$

$$\sin\theta = \frac{3}{13}$$

$$= .2307692+.$$

From the Tables of Natural Sines :—

Sin 13° 20′ = .2306159,

and the difference ·0001513 = 32″,

$\therefore \theta = 13° 20′ 32″$;

and Sin θ = Sin (180° − θ)

$\therefore \theta = 180° - 13° 20′ 32″$

$= 166° 39′ 28″$.

$\therefore \theta = 13° 20′ 32″$ and $166° 39′ 28″$. Ans.

(b) $5 \tan\theta + 2 = 0$

$$\tan\theta = -\frac{2}{5}$$

$$\frac{\sin\theta}{\cos\theta} = -\frac{2}{5}$$

$$\frac{\sin^2\theta}{\cos^2\theta} = \frac{4}{25}$$

$$\frac{\sin^2\theta}{1 - \sin^2\theta} = \frac{4}{25}$$

$$\frac{\sin^2\theta}{1} = \frac{4}{25 + 4}$$

$$\sin^2\theta = \frac{4}{29}$$

$$\therefore \sin\theta = \sqrt{\frac{4}{29}}$$

$$= \sqrt{.13793103448275+}$$

$= .13793103448275$ (·3713

9

67 | 479

469

741 | 1031

741

7423 | 29003

22269

7426) 6734448(906

66834

51048

44556

6492

$\therefore$ Sin θ = ·3713906+.

From the Tables of Natural Sines :—

Sin 21° 48′ = ·3713678,

and the difference ·0000228 = 5″,

$\therefore \theta = 21° 48′ 5″$,

and the supplement $= 180° - 21° 48′ 5″$

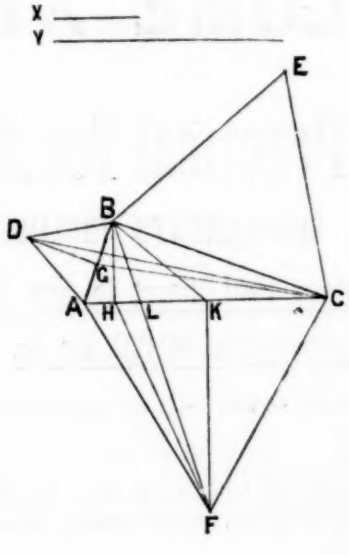
$= 158° 11′ 55″$;

now $\tan\theta = -\frac{2}{5}$,

$\therefore \theta = 158° 11′ 55″$. Ans.

Iota.—Construct an equilateral triangle equal to the sum of two given ones.—(*1st Arts. R.U.I.*)

Let X and Y be the sides of the two given equilateral triangles.



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Draw AB = X, and at B draw BC at right angles to AB and equal to Y. Join AC.

Then the equilateral triangle described on AC shall be equal to the equilateral triangles described on AB and BC.

On AB, BC, and CA describe the equilateral triangles ABD, BCE, and ACF.

Join BF and DC.

Then BA, AF = DA, AC,
and ∠BAF = ∠DAC ;
∴ △ BAF = △ DAC (I. 4).

Draw DG perpendicular to AB, and join GC.

△ DGB = △ DGC (I. 37);
∴ △ DAC = △s DAG, DGB, AGC
= △s ABD, AGC
= △ ABD and ½ △ ABC.

Draw BH, FK perpendicular to AC, and join FH, BK.

△ FKH = △ FKB (I. 37).

Take away the common part FKL ;

∴ △ FLH = △ BLK (Ax. 3).
Now △ BAF = △s BAL, AHF, FLH
= △s AHF, BAL, BLK
= △s AHF, BAK
= △ AHF and ½ △ ABC.
But △ BAF = △ DAC ;
∴ △ AHF and ½ △ ABC = △ ABD and ½ △ ABC ;
wherefore △ AHF = △ ABD.

Similarly it can be proved that △ CHF = △ BCE.

∴ Equilateral triangle ACF = sum of equilateral triangles ABD, BCE.—Q.E.F.

J.M.A.—A man left his property to A, B, and C ; to A he left £180 less than ⅛ of his property, to B ⅓, to C the rest, which was £590 less than what A and B had received ; what was the property ?

A and B received (⅛ + ⅓) of property — £180
= $\frac{7}{12}$ of property — £180 ;
Remainder = Property — ($\frac{7}{12}$ of property — £180)
= $\frac{5}{12}$ of property + £180 ;
But C received $\frac{7}{12}$ of property — £180 — £590
= $\frac{7}{12}$ of property — £770 ;
∴ $\frac{7}{12}$ of property — £770 = $\frac{5}{12}$ of property + £180,
($\frac{7}{12}$ − $\frac{5}{12}$) of property = £180 + £770,
$\frac{1}{6}$ of property = £950,
∴ Property = £950 × 6
= £5,700. Ans.

Belle.—Can n have all values in x^n ? Assign a meaning to, and (if possible) find the value of $10^{\sqrt{2}}$.

The index n can have any value.

In the case of $10^{\sqrt{2}}$, the $\sqrt{2}$ is the logarithm of 10.

$\sqrt{2} = 2(1\cdot4142$

```
        1
  24 | 100
       96
 281 | 400
       281
2824 | 11900
       11296
28282 | 60400
        56564
         3836.
```

28284)38360(135
28284
100760
84852
159080
141420
17660

∴ $\sqrt{2}$ = 1·4142135 +
number corresponding to this log
= 25·95454 +
∴ $10^{\sqrt{2}}$ = 25·95454 +. Ans.

Belle.—If R is the remainder when P is divided by Q, prove that the highest common factor of Q and R is the same as that of P and Q. (*Matric., June* 1892.)

```
   Q) P(a
      aQ
   ---
   R) Q(b
      bR
   ---
   S) R(c
      cS.
```

Suppose S goes with R exactly. Every expression which divides P and Q divides $P - aQ$ or R ; thus every expression which is a measure of Q and R is a measure of P and Q.

Similarly every expression which divides Q and R divides $Q - bR$ or S ; thus every expression which is a measure of Q and R is a measure of R and S.

But no expression higher than S can divide S.

Therefore S is the highest common factor of Q and R, and consequently of P and Q.

J. M. A.—A man sells an article at 5 per cent. profit ; if he had bought it at 5 per cent. less than he did, and sold it for 1s. less, he would have gained 10 per cent. Find the cost price.

Suppose cost price were £100,
Then selling price = £105 ;
If bought at 5 per cent. less, the cost price would have been £95,
And selling price in this case
= £95 + 10% in £95
= £95 + £9 10s.
= £104 10s. ;
Difference between the two selling prices
= £105 — £104 10s.
= 10s.,
∴ Cost price = £100 × $\frac{1}{10}$
= £10. *Ans.*

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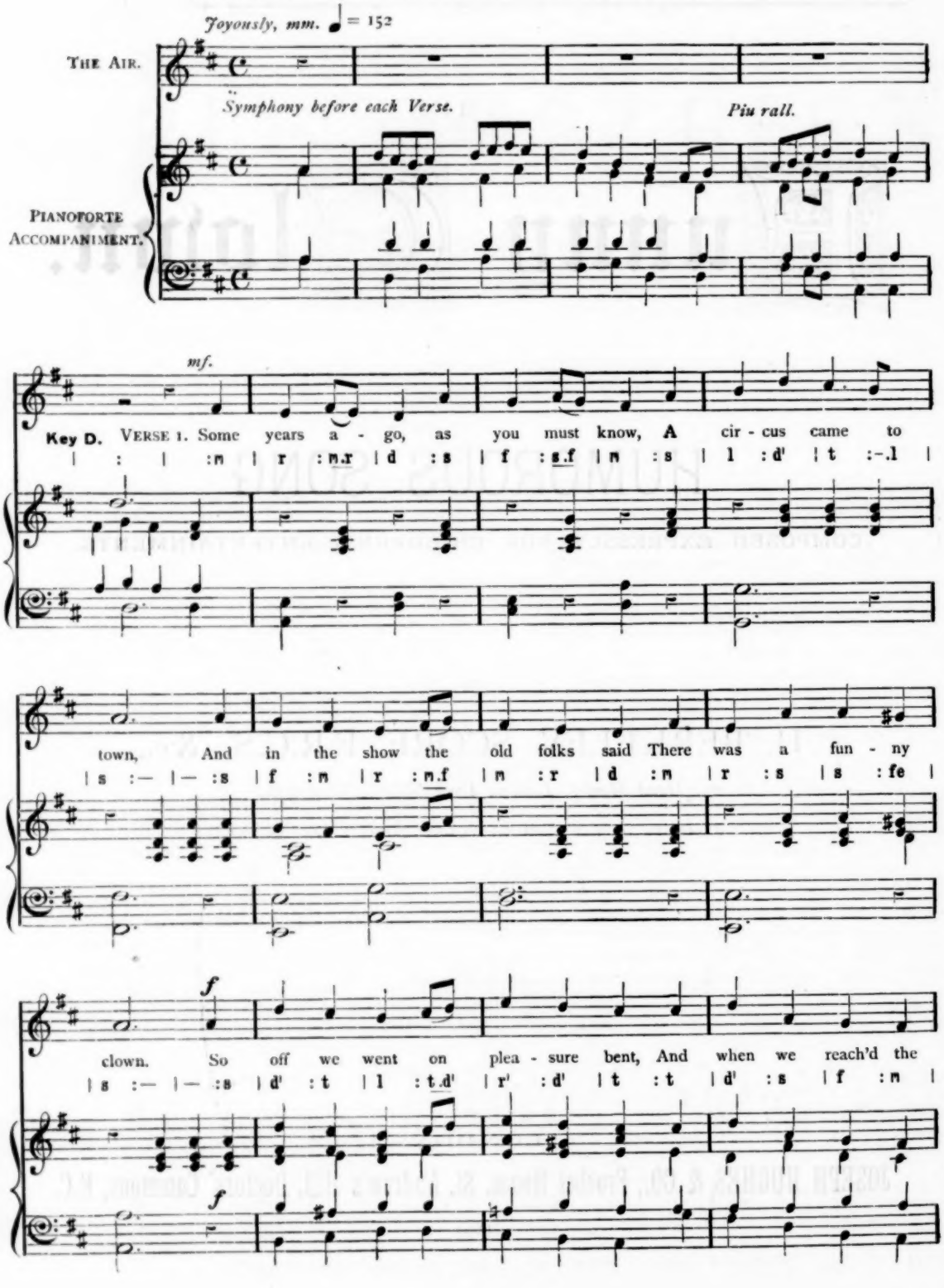
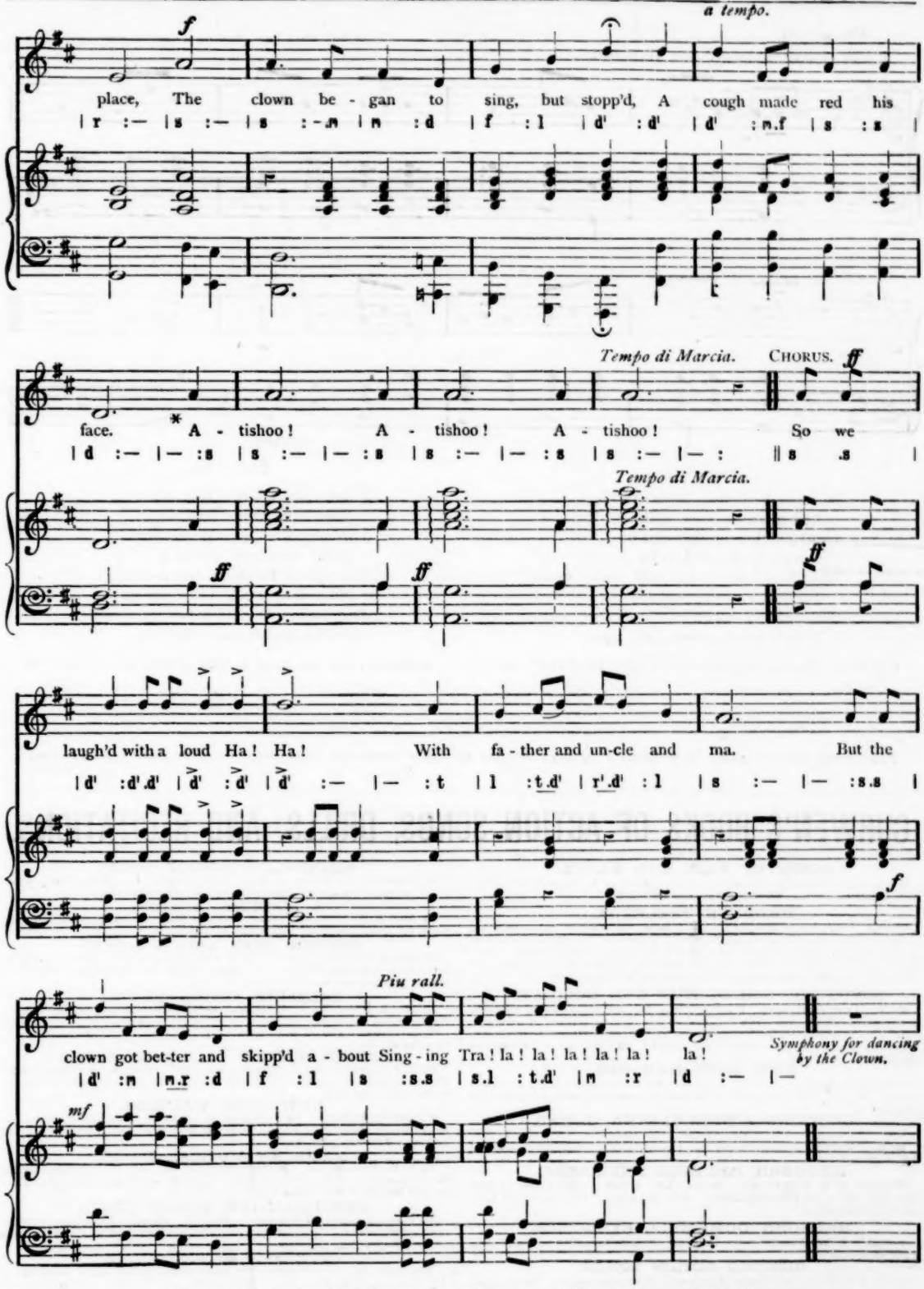
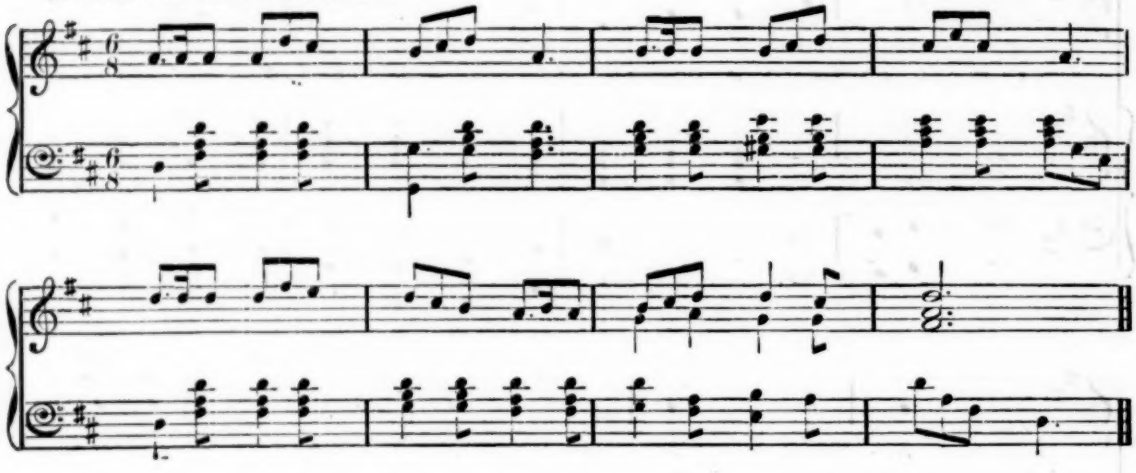
THE FUNNY CLOWN.

Joyously, mm. ♩ = 152
THE AIR.
Symphony before each Verse.
Piu rall.
PIANOFORTE ACCOMPANIMENT.
mf.
Key D. VERSE 1. Some years a - go, as you must know, A cir - cus came to
| : | :m | r :m.r | d :s | f :s.f | m :s | l :d' | t :-.l |
town, And in the show the old folks said There was a fun - ny
| s :— | — :s | f :m | r :m.f | m :r | d :m | r :s | s :fe |
f
clown. So off we went on plea - sure bent, And when we reach'd the
| s :— | — :s | d' :t | l :t.d' | r' :d' | t :t | d' :s | f :m |
f

a tempo.
f
place, The clown be - gan to sing, but stopp'd, A cough made red his
Tempo di Marcia.
CHORUS.
ff
face. * A - tishoo! A - tishoo! A - tishoo! So we
Tempo di Marcia.
ff
ff
ff
laugh'd with a loud Ha! Ha! With fa - ther and un-cle and ma. But the
f
Piu rall.
clown got bet-ter and skipp'd a - bout Sing - ing Tra! la! la! la! la! la! la!
Symphony for dancing by the Clown.
mf

* *Instead of singing 'Atishoo!' three times, the children may cough loudly.*

Mm. ♩ = 84.

PIANO ACCOMPANIMENT FOR DANCING.

VERSE II.

He then verse two began to do,
And all went very well,
Until another brother-clown
Uttered a dreadful yell;
This made our clown, with angry frown,
Turn face about, and then
The unlucky cough came on once more,
Which much amused the men.

CHORUS: So we laugh'd with a loud Ha! Ha! etc.

VERSE III.

I never shall forget the man
Who sang that comic song;
I wonder what he's doing there,
Amid life's busy throng!
The ugliest frown in any town
That song would chase away,
And when I'm dull, I love to think
Of his quaint voice that day.

CHORUS: So we laugh'd with a loud Ha! Ha! etc.

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